ELEMENTARY NOTES

FOR THE

FIELD ARTILLERY DRIVER AND CANNONEER

W. P. ENNIS, LIEUT. COL. U. S. A.

ELEMENTARY NOTES

FOR THE

FIELD ARTILLERY DRIVER AND CANNONEER

ELEMENTARY NOTES

FOR THE

FIELD ARTILLERY DRIVER AND CANNONEER

COMPILED FOR THE UNITED STATES CORPS OF CADETS UNDER THE DIRECTION OF THE COMMANDANT OF CADETS

BY

LIEUT. COL. W. P. ENNIS

PHILADELPHIA AND LONDON
J. B. LIPPINCOTT COMPANY

PRINTED BY J. B. LIPPINCOTT COMPANY
AT THE WASHINGTON SQUARE PRESS
PHILADELPHIA, U. S. A.

PREFACE

DUE to the limited time allowed cadets at the United States Military Academy for field artillery instruction, it was felt that an abridged text-book of some kind was necessary. It was also thought that a course along the general line of the field artillery gunner's examination, but a little more extended in scope, would meet the requirements.

For this reason "Elementary Notes for Field Artillery Driver and Cannoneer" was compiled.

It has now been in use at West Point for about one year and has been found of material assistance in the instruction of the Fourth and Third Classes.

During the past summer numerous requests have been received for copies which could not be supplied.

It is for the above reason that it is now published.

THE AUTHOR.

November, 1917.

ELEMENTARY NOTES
FOR THE
FIELD ARTILLERY DRIVER AND CANNONEER

THE BATTERY DISMOUNTED.

1. The movements and formations prescribed for the battery dismounted or any of its parts, correspond with obvious modifications to similar movements in the Infantry Drill Regulations.

2. For technical, tactical, and administrative purposes the enlisted personnel of the battery is assigned to sections. A **section dismounted** consists of one sergeant, who is chief of section, and all the men assigned to the service of a piece and its caisson, called a **gun section**; or to the service of two caissons, called a **caisson section.** The leading caisson of a caisson section is the **first caisson**; the rear caisson, the **second caisson.** The section assigned to the service of the battery wagon and the store wagon and to the service of the tools carried in those wagons is called the **ninth section.** The section assigned to the service of supply is called the **supply section.** At dismounted formations the members of the supply section, unless assigned elsewhere, habitually form in the line of file closers of the ninth section.

3. The first four sections of the battery are **gun sections.** The remaining sections, except the ninth section and the supply section, are **caisson sections.** Each gun section consists of a **gun squad** and a **driver squad.** Each caisson section consists of a **caisson squad** and a **driver squad.** The ninth section consists of a **mechanic squad** and a **driver squad.**

4. Each **section dismounted** is formed in line, with the gun squad, caisson squad, or mechanic squad on the right, the driver squad on the left. Men temporarily attached to sections fall in in the line of file closers or at such other places as may be designated.

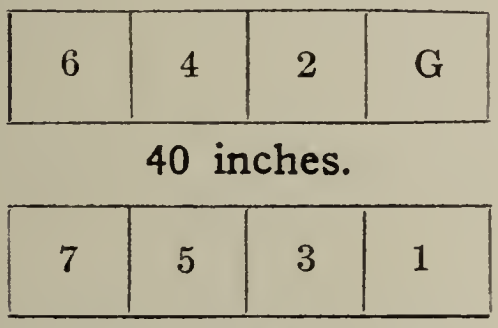
5. Each **gun squad** consists of one of the corporals and seven of the privates assigned to the service of a gun section. The corporal is the **gunner** and should be selected for his qualifications without regard to his rank in the section. The privates are **cannoneers,** numbered from No. 1 to No. 7.

6. Each **caisson squad** consists of one of the corporals and seven of the privates assigned to the service of a caisson section. The corporal is a **caisson corporal.** The privates are **cannoneers,** three of whom are assigned to the first caisson and numbered from No. 4 to No. 6, and the remaining four to the second caisson and numbered from No. 4 to No. 7.

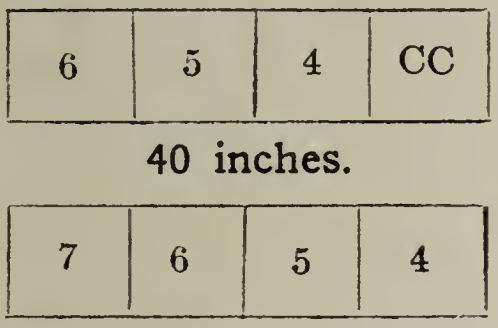
Movements prescribed for a gun squad apply, with obvious modifications, to a caisson, driver, or mechanic squad.

7. Each **driver squad** of the gun and caisson sections consists of a **caisson corporal,** the six drivers of the carriages of the section, and an extra cannoneer, No. 8, who is trained as a spare driver.

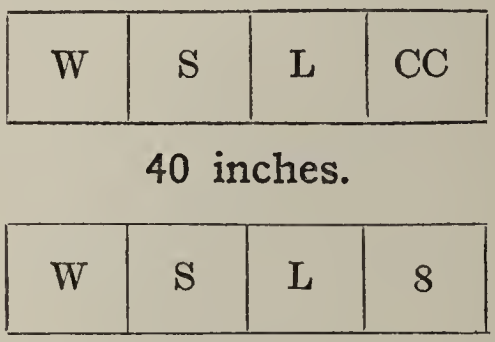
8. Each gun squad is formed in double rank as follows: The gunner and Nos. 2, 4, and 6 in the front rank in order from right to left; Nos. 1, 3, 5, and 7 in the rear rank, in order from right to left; No. 1 covering the gunner.



9. Each caisson squad is formed in double rank as follows: The caisson corporal and Nos. 4, 5, and 6 of the first caisson in the front rank in order from right to left; Nos. 4, 5, 6, and 7 of the second caisson in the rear rank, in order from right to left; No. 4 covering the caisson corporal.



10. Each driver squad is formed in double rank as follows: The caisson corporal is on the right of the front rank; the lead, swing, and wheel drivers of the piece in a gun section, or of the first caisson in a caisson section, are on the left of the caisson corporal in order from right to left; the lead, swing, and wheel drivers of the caisson in a gun section, or of the second caisson in a caisson section, are in the rear rank in order from right to left covering the drivers of the front rank; the spare driver, No. 8, is in the rear rank covering the caisson corporal.



The driver squad of the ninth section is similarly formed, the spare lead and spare wheel drivers taking, respectively, the places prescribed for the caisson corporal and No. 8.

11. In the fifth section the driver squad is formed with the telephone corporal of the battery commander's detail as its corporal; the scout corporals and the signal privates of that detail fall in as file closers of the section.

12. The mechanic squad is formed in double rank as follows: In the front rank the chief mechanic is on

the right and three of the mechanics are on his left; in the rear rank, covering the men in the front rank, are the four remaining mechanics.

13. In a battery on a peace footing the spare cannoneers assigned to the ninth section constitute a squad, which forms on the left of the driver squad.

14. At dismounted formations, if a squad contains less than six men, it is increased to that number by transfers from other squads, or is broken up and its members assigned to other squads and posted in the line of file closers.

When a squad consists of six men, both of the interior files are blank; when of seven men, one such file is blank.

15. A **platoon dismounted** consists of one lieutenant, who is **chief of platoon,** and two sections dismounted.

The platoon dismounted is formed in double rank, with the sections arranged from right to left in the order of their permanent numbers.

16. A **battery dismounted** comprises the personnel shown in detail in Tables of Organization I and II.

17. The battery dismounted is formed in double rank with the platoons arranged from right to left in the order of their permanent numbers.

The senior lieutenant is, at formations and exercises of the battery dismounted, assigned as chief of the first platoon. The lieutenant next in rank is assigned as chief of the second platoon, and so on.

Chiefs of platoon and section supervise the movements of their units.

18. When only a part of the battery is formed for dismounted instruction, the word **section** or **platoon,** as the case may be, is substituted in the commands for **battery.**

Posts of Officers, Noncommissioned Officers, Etc.

In Line.

19. The captain: Four yards in front of the center of the battery.

Chiefs of platoon: Two yards in front of the center of their platoons.

The fourth lieutenant, when there are but three platoons: In the line of file closers, opposite the center of the battery.

The first sergeant: In the front rank, 1 yard from the right of the first section.

The supply sergeant: In the front rank, 1 yard from the left of the left section.

The mess and stable sergeants: In the line of file closers of the ninth section.

Chiefs of section: One yard in front of the center of their sections.

Corporals: The right man of the front rank of their squads, except the scout corporals, who are in the line of file closers of the fifth section.

The guidon and the musicians: In the line of file closers of the first section.

Other men for whom there is no place in the squads: In the line of file closers in rear of the section to which they belong or are attached.

In Column of Squads.

20. The captain: Four yards from the flank, opposite the center, on the left (right) when the first (ninth) section is in front.

Chiefs of platoon: On the same side as the captain, 2 yards from the flank and opposite the center of their platoons.

The fourth lieutenant, when there are but three platoons: On the side opposite the captain, 2 yards from the flank and opposite the center of the column.

The first sergeant: Either 40 inches in front of the guiding file of the leading squad or 40 inches in rear of the guiding file of the rear squad, according as the column has been formed by executing squads right or squads left from line.

The supply sergeant: Either 40 inches in rear of the guiding file of the rear squad or 40 inches in front of the guiding file of the leading squad, according as the column has been formed by executing squads right or squads left from line.

Chiefs of section: On the same side as the captain and 4 inches from the flank man of the front rank of the rear squad of their section.

The file closers: On the side opposite the captain and abreast of and 4 inches from the flank of the squad in rear of which they are posted in line.

To Form and to Dismiss the Battery.

21. At the sounding of the **assembly**, the first sergeant, facing the battery and 6 yards in front of where the center is to be, commands: 1. **Fall in**, 2. **CALL ROLLS**, 3. **REPORT.**

At the command **fall in**, the gunners, caisson corporals, telephone corporal, and chief mechanic place themselves on the line facing to the front in their proper order, at sufficient distance apart for the formation of their squads; each squad forms on its corporal; the chiefs of section take their posts facing their sections. The assembly having ceased, the first sergeant causes the sections to close to the right, if necessary.

At the command **call rolls**, the chiefs of section call the rolls and then face to the front.

At the command **report**, the chief of the first section salutes and reports: **First section, present**; or **First section Corporal —— and Private(s) —— are absent.** The first sergeant, having received and verified this report, returns the salute. The chief of the second section then reports in like manner, and so on. Men who are known to be absent by proper authority are not reported absent by the chiefs of section. After receiving the reports, the first sergeant faces about, salutes the captain, and reports: **Sir, the battery is present or accounted for**; or, **Sir (so many), noncommissioned officers or privates are absent.** The first sergeant then takes his post.

The captain places himself 12 yards in front of the

center of the battery, superintends the formation, and receives the report of the first sergeant, whose salute he returns.

The lieutenants take their posts as soon as the first sergeant has reported.

During instruction the officers have the saber drawn or in the scabbard, at the discretion of the captain. When the captain draws saber, the lieutenants also draw saber.

To Open Ranks.

22. Being in line at a halt: 1. **Open ranks,** 2. **MARCH,** 3. **FRONT.**

At the command **march** the front rank executes **right dress**; the rear rank and the field closers march backward four steps, halt, and execute **right dress**; the fourth lieutenant, when only three platoons are present, marches backward 4 steps and halts; the chiefs of platoon step forward 2 yards, the chiefs of section 1 yard, and all dress to the right. The captain goes to the right flank of the battery and aligns the chiefs of platoon, the chiefs of section, the front rank, the rear rank, and the file closers.

Before giving the command **front** the captain places himself in front of the post of the first sergeant and on a line with the chiefs of platoons and faces to the left. At the command **front** all the men turn their heads and eyes to the front, and those in ranks drop the left arm.

After the command **front** has been executed, the captain places himself 6 yards in front of the center of the battery, facing to the front.

To Close Ranks.

23. Being at open ranks: 1. **Close ranks,** 2. **MARCH.**

At the command **march,** the lieutenants and chiefs of section face about and resume their posts in line; the rear rank closes to 40 inches, each man covering his file leader; the file closers close to 2 yards from the rear rank; the captain then takes his post in line.

Alignments.

24. The alignments are executed as prescribed for the squad; the base squad may, if desired, be established instead of the base file. In aligning the battery, the captain places himself in prolongation of the line, 2 yards from and facing the flank toward which the alignment is made; after commanding **front,** he resumes his post.

To Dismiss the Battery.

25. Being in line at a halt:

The captain directs the first sergeant: **Dismiss the battery,** and returns the salute of the first sergeant.

The officers fall out; the first sergeant salutes, steps 3 yards to the front, faces to the left, and commands: **DISMISSED.**

In exceptional cases the battery may be dismissed from any formation, either at a halt or marching.

Formation of the Gun Squads.

To Form the Gun Squads.

26. The instructor indicates the place of formation and commands: **FALL IN.**

Each gunner repeats the command and hastens to place himself, faced to the front, where the right of his squad is to rest.

The cannoneers move at double time and take their places.

27. The place of formation is indicated and the command given thus, for example: 1. **In front (rear) of your pieces (caissons)**; or, 1. **On the right (left) of your pieces (caissons) facing them**; or, 1. **On the road facing the park, 2. FALL IN.**

28. In case the front or rear of the carriages is designated, each squad falls in at its post.

29. For the first formation of the gun squads for any drill or exercise the instructor cautions **as gun squads** before giving the command.

To Tell Off the Squads.

30. **CALL OFF.** In each gun squad the cannoneer on the right of the rear rank calls off **one**; the cannoneer on the left of the gunner, **two**; the cannoneer on the left of No. 1, **three**; and so on. The gunner does not call off.

In each caisson squad the cannoneers of the front rank call off first, thus: **four, five, six,** in order from right to left, followed by the cannoneers of the rear rank in the same order. The caisson corporal does not call off.

After having called off, if a subsequent formation is ordered, the cannoneers fall in at once in their proper order.

Posts of Gun Squads and Cannoneers; Mounting and Dismounting.

Posts of the Gun Squads, Carriages Limbered.

31. **In front of the pieces or caissons:** Each squad is in line facing to the front, its rear and center 2 yards from the end of the pole or from the heads of the lead horses.

32. **In rear of the pieces or caissons:** Each squad is in line facing to the front, its front and center 2 yards from the muzzle or from the rear of the caisson.

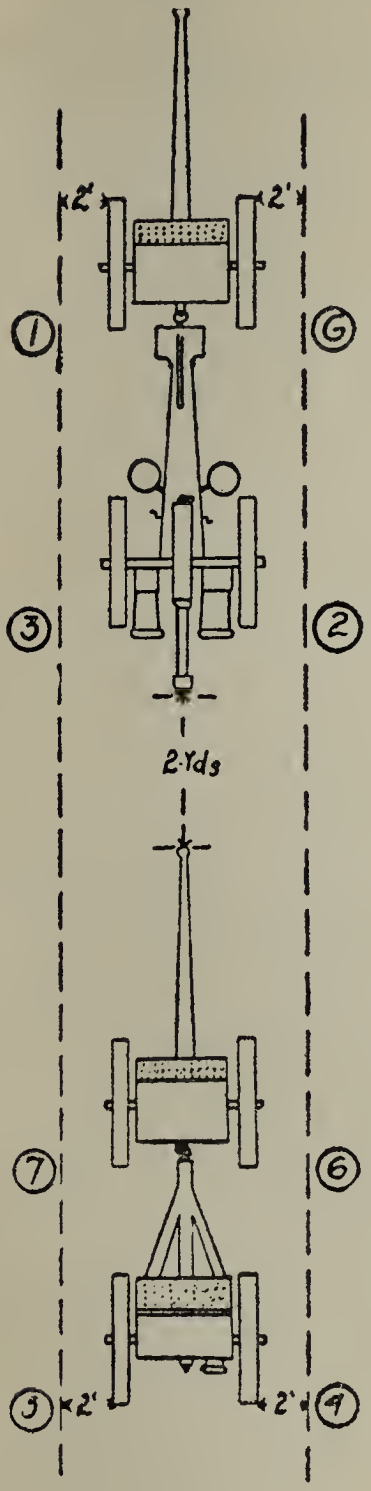
33. If no special place of formation is designated, each squad, when formed at the carriages, is posted in front of the leading carriage of its section.

To Post the Gun Squads.

34. The squads are marched to the park, and, on arrival near the carriages, the instructor commands: **Squads in front (rear) of your pieces (caissons).**

Each gunner marches his squad to its carriage and posts it in the indicated position.

35. The instructor habitually causes the squads to approach the front (rear) of the carriages which he designates in his command, from the right of the park if left in front and from the left if right in front.



Posts of the Cannoneers, Carriages Limbered.

36. The gunner and No. 1 opposite the rear of the limber wheels of the piece.

Nos. 2 and 3 opposite the rear of the gun wheels.

Nos. 4 and 5 opposite the rear of the caisson wheels.

Nos. 6 and 7 opposite the rear of the limber wheels of the caisson.

The gunner and even numbers are on the right, the odd numbers on the left, all 2 feet outside the wheels, facing the front.

To Post the Cannoneers.

37. 1. **Cannoneers**, 2. **POSTS.** Each gunner repeats the command **posts.** The cannoneers leave the ranks, if formed, and move at double time by the shortest practicable routes to their posts.

38. For preliminary instruction the squads, on entering the

park, are first posted with their carriages; the cannoneers are then sent to their posts by the foregoing command. The command is general, however, and is applicable when the cannoneers are in or out of ranks, at a halt or marching, and when the carriages are limbered or unlimbered.

To Mount the Cannoneers on the Carriages Limbered.

39. In each squad the gunner and No. 1 mount on the limber chest of the piece.

Nos. 2 and 3 mount on the axle seats.

Nos. 4 and 5 mount on the caisson chest.

Nos. 6 and 7 mount on the limber chest of the caisson.

When extra cannoneers are present:

No. 8 mounts between Nos. 6 and 7.

No. 9 mounts between Nos. 4 and 5.

The gunner and even numbers mount on the right side of their respective carriages, odd numbers on the left.

40. 1. **Cannoneers, prepare to mount,** 2. **MOUNT.**

At the first command the cannoneers who mount on the limber chests or axle seats hasten to the rear of the limber chests or axle seats; those who mount on the caisson chest hasten to the front of that chest. Each cannoneer who mounts on the limber chest places the foot nearest the wheel on the step, grasps the chest handle with the hand nearest the wheel, and with the other hand grasps the hand of the cannoneer opposite him. Each cannoneer who mounts on the caisson chest places the foot nearest the wheel on the step, and grasps

the chest handle with the hand nearest the wheel. Cannoneers who mount on the axle seats place the foot nearest the wheel on the brake beam, and grasp the seat handle with the hand nearest the wheel.

At the command **mount,** all spring up and seat themselves, those on the chests facing to the front, those on the axle seats to the rear. Those who mount on the limber chests place the foot farthest from the wheel on the top of the limber chest, and then step down on the footboard.

41. If the command be: 1. **Cannoneers,** 2. **MOUNT,** the cannoneers execute, at the command **mount,** all that has been prescribed for the commands **prepare to mount** and **mount.**

To Dismount the Cannoneers from the Carriages.

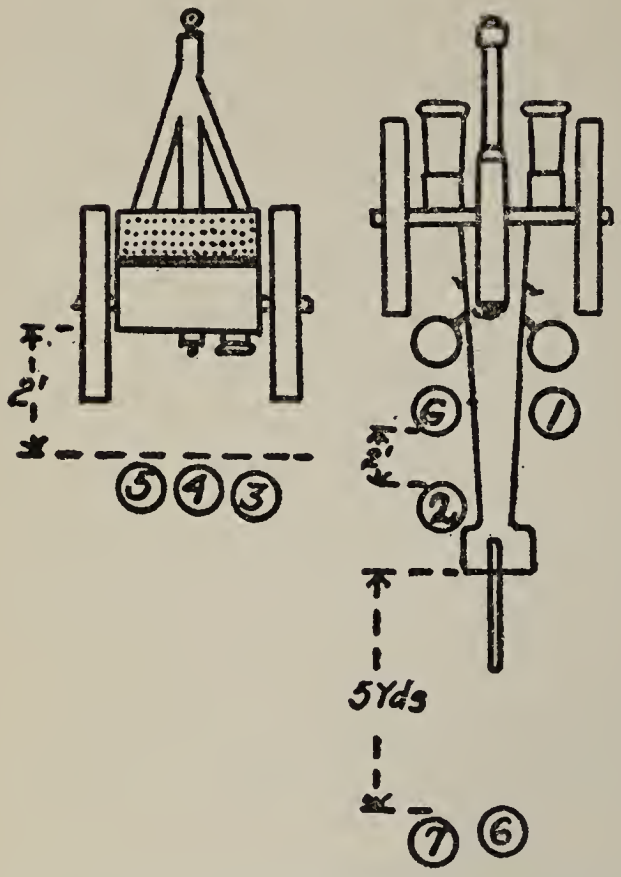
42. 1. **Cannoneers, prepare to dismount,** 2. **DISMOUNT.**

The cannoneers on the chests stand up on the footboards at the first command; at the second command all the cannoneers jump to the ground and take their posts at the double time.

43. If the command be: 1. **Cannoneers,** 2. **DISMOUNT,** they execute, at the command **dismount,** all that has been prescribed for the commands **prepare to dismount** and **dismount.**

Posts of the Cannoneers, Carriages Unlimbered but not Prepared for Action.

44. In each squad the gunner immediately in rear of the cannoneer's seat, on the left side of the trail of the gun.



No. 1, immediately in the rear of the cannoneer's seat, on right side of trail of gun.

No. 2, 2 feet in rear of the gunner, covering him.

Nos. 3, 4, and 5, 2 feet in rear of the caisson chest in the order named from right to left.

Nos. 6 and 7, abreast and in order from right to left, 5 yards in rear of the trail spade.

Higher-numbered cannoneers, if present, accompany the limbers. The cannoneers stand at attention at their posts, facing to the front.

To Change the Posts of the Cannoneers.

45. In order to exercise the cannoneers in all duties connected with the service of the piece, to vary the drill, and to fix the attention of the men, the posts of the cannoneers are frequently changed.

46. The cannoneers being at their posts, carriages limbered or unlimbered: 1. **Change posts,** 2. **MARCH.**

In each squad No. 1 quickly takes the post of No. 2, No. 2 of No. 3, No. 3 of No. 4, No. 4 of No. 5, No. 5 of No. 1. Higher-numbered cannoneers change only when specially directed.

Movements of the Carriages by Hand.

To Move by Hand the Carriages Limbered.

47. **To the front: 1. Pieces (Caissons) forward, 2. MARCH, 3. HALT.** In each squad, at the first command, the gunner and No. 1 hasten to the end of the pole; Nos. 2 and 3 to the limber wheels; Nos. 4 and 5 to the rear wheels; higher-numbered cannoneers to the rear of the carriage; the gunner and even numbers working on the right side of the carriage, odd numbers on the left. The cannoneers who work at the pole or at the wheels grasp the same with both hands; those in rear of the carriage prepare to push against the most convenient part of the carriage.

At the command **march,** all assist in moving the carriage to the front. At the command **halt,** the carriage is stopped, the pole is lowered to the ground, and all resume their posts.

48. **To the rear: 1. Pieces (Caissons) backward, 2. MARCH, 3. HALT.** Executed as in the preceding paragraph, except that at the command **march** the cannoneers move the carriage to the rear and that the higher-numbered cannoneers place themselves in front of the rear axle of the carriage and push against the most convenient part of the carriage.

Duties of the Cannoneers in Unlimbering.

Disposition of the Carriages Before and After Unlimbering.

49. **Before unlimbering:** The piece and its caisson are placed abreast of each other, 2 yards apart, poles

pointing in the same direction. This formation of the carriages is called a **double section.** The interval of 2 yards should not be materially changed, otherwise the amount of movement of the carriages by hand is greatly increased.

50. If it is intended to fire to the front, the caissons should be placed on the left of their pieces before the command for unlimbering is given; if it is intended to fire to the rear, the caissons should be on the right of their pieces; if to the flank, on either side of their pieces. In emergencies the carriages may be unlimbered from any formation. Dispositions to meet various situations should be practiced.

51. When not horsed the carriages are drawn by the cannoneers and the instructor gives the necessary instructions for moving the carriages by the shortest routes into the prescribed positions.

52. After unlimbering: The adjacent wheels of the gun and caisson are about 1 foot apart, the gun muzzle and the caisson trail pointing to the front, the gun on the right and slightly in advance of the caisson.

The gun is placed slightly in advance to allow for recoil at the first shot, which on ordinary ground is about 10 inches.

The interval of 1 foot may be increased to permit wide movements of the trail if they are anticipated, but effort should be made to preserve the protection afforded by the shields.

In emergencies the caissons may be placed temporarily on the right of their pieces. As this position is not favorable to the service of ammunition, the caissons should be placed on the left of their pieces as soon as practicable.

53. In active service and in instruction simulating service conditions, the limbers are placed under cover in the vicinity of the position; if no cover is obtainable in the vicinity, they are placed in line in rear of either flank at such place as the instructor may designate.

To Unlimber.

General Rules.

54. 1. In unlimbering to fire to the front each caisson establishes the position.

2. In unlimbering to fire to the rear, each piece establishes the position.

3. In unlimbering to fire to the flank, the element (gun or caisson) on the side toward which fire is to be directed establishes the position.

4. If the carriages, after unlimbering, have to be moved by hand to the firing position, all the cannoneers of the gun squad, when the ground is difficult, assist at each carriage in turn in moving it to the designated position.

5. In drills with the carriages not horsed, spare cannoneers or those higher in number than No. 5 are used to move the limbers to the place designated by the instructor.

6. If the carriages are not horsed, they are unlimbered successively, the one which establishes the position being unlimbered first. The limbers are drawn by cannoneers designated by the instructor. Thus, if only the gunner and five cannoneers are present, the cannoneers posted with the piece may be required to move the limber of the caisson, and those with the caisson, the limber of the piece. If higher-numbered cannoneers are present, however, they are ordinarily used for this purpose.

To Fire to the Front.

55. The carriages being in double section the caissons on the left: **ACTION FRONT.** If marching, the carriages halt at the command or signal. The cannoneers, if mounted, dismount after the carriages have halted.

The Caissons: Nos. 4 and 5 jump to the trail handles. Nos. 6 and 7, if present, run to the right and left caisson wheels, respectively, and stand ready to assist in such movements of the carriage as may be necessary. No. 4 unlatches the pintle; Nos. 4 and 5 raise the trail from the pintle; and No. 4, by raising his arm, signals for the drivers to drive on; Nos. 4 and 5 then lower the trail to the ground. No. 4 sets the brake, and all the cannoneers at the caisson take their posts.

The Pieces: The gunner and No. 1 jump to the trail handles. No. 2 runs around the muzzle of the gun to the wheel that is to become the right wheel of the piece unlimbered and places himself so as to be ready to turn

the top of his wheel toward the trail. No. 3 runs around the muzzle of the gun to the wheel that is to become the left wheel of the piece unlimbered and places himself so as to be ready to turn the top of his wheel toward the muzzle. The gunner unlatches the pintle, and, assisted by No 1, raises the trail from the pintle. The gunner, by raising his arm, signals for the drivers to drive on. The gunner and No. 1 carry the trail away from the caisson and all of the cannoneers working together turn the piece around 180°. The gunner causes the piece to be placed by the side of the caisson. The gunner and No. 1 lower the trail to the ground, and all the cannoneers at the piece take their posts.

Limbers: At the signal **drive on,** the limbers take their prescribed positions.

To take posts in rear of the carriages each caisson limber executes a left about, moves straight to the rear, executes another left about, and halts, so that the heads of the lead horses or the end of the pole will be 25 yards from the rear of the caisson. Each piece limber follows the caisson limber, passes around in rear of it, and halts so as to be abreast of it and 2 yards to its right.

In horse batteries, Nos. 6 and 7 do not assist at the caisson.

To Fire to the Rear.

56. The carriages being in double section, the caissons on the right: **ACTION REAR.** If marching, the carriages halt at the command or signal. Cannoneers, if mounted, dismount after carriages are halted.

The Caisson: Nos. 4 and 5 jump to the trail handles. Nos. 6 and 7, if present, run to the right and left caisson wheels, respectively. No. 6 stands ready to turn the top of his wheel away from the trail while No. 7 stands ready to turn his toward the trail. No. 4 unlatches the pintle; Nos. 4 and 5 raise the trail from the pintle and No. 4, by raising his arm, signals for the drivers to drive on; Nos. 4 and 5 carry the trail away from the piece and all the cannoneers working together turn the caisson around 180° and place it by the side of the piece; Nos. 4 and 5 lower the trail to the ground. No. 4 sets the brake and all of the cannoneers working on the caisson take their posts.

The Piece: The gunner and No. 1 jump to the trail handles. No. 2 runs around the muzzle of the gun to the wheel that is to become the right wheel of the piece unlimbered, and stands ready to assist in such movements of the carriage as may be necessary. No. 3 runs around the muzzle of the gun to the wheel that is to become the left wheel of the piece unlimbered, and stands ready to assist in such movements of the carriage as may be necessary. The gunner unlatches the pintle and, assisted by No. 1, raises the trail from the pintle. The gunner, by raising his arm, signals for the drivers to drive on. The gunner and No. 1 lower the trail to the ground and all the cannoneers at the piece take their posts.

Limbers: To take post in rear of the carriages, each caisson limber inclines well to the right, moves to the

rear, executes a left about, and halts so that the heads of the lead horses or the end of the pole will be 25 yards from the rear of the caisson. Each piece limber follows the caisson limber, passes around in rear of it, and halts so as to be abreast of it and 2 yards to its right.

In horse batteries, or when Nos. 6 and 7 are not present, Nos. 2 and 3 perform the duties prescribed for Nos. 6 and 7, respectively, as soon as the piece trail is lowered to the ground.

To Fire to the Flank.

57. The caisson being on either side of the piece, 2 yards from and abreast of it: ACTION RIGHT (LEFT).

Executed according to the principles of *action front* and *action rear,* with the following modifications: After the carriages are unlimbered the muzzle of the gun and the trail of the caisson are turned in the direction of fire, and the carriage in rear is run up to its proper position on the line. The carriage on the side toward which fire is to be delivered is first established in position and then all the cannoneers assist in bringing up the carriage in rear to its proper place.

Limbers: To take post in rear of their carriages, the limber farthest from the flank toward which fire is to be delivered moves out first, wheels away from the direction of fire, and after having gained sufficient distance to the rear executes an about and halt at the prescribed position. The other limbers follow and take position in a similar manner.

Duties of the Cannoneer in Limbering.

58. The carriages being in position unlimbered and in march order, to limber to the front and rear: 1. *Limber,* 2. **FRONT AND REAR.**

In each squad the gunner and No. 1 face to the rear at their posts. No. 2 places himself at the right of the gunner, facing to the rear. No. 3 jumps across the trail of the piece and places himself on the left of No. 1, facing to the rear. Nos. 4 and 5 hasten to the front of the caisson; No. 4 releases the brake, and both place themselves with their backs towards the chest, close up against the footboards, No. 4 on the right, No. 5 on the left of the trail. No. 6 passes around the right of the piece and places himself on the right of No. 4. No. 7 runs around the left of the caisson and places himself on the left of No. 5.

The limbers are brought up so as to move squarely across the direction of the trails and so that the wheel nearest the trail will pass about a foot outside of the lunette.

When the axle of the piece limber is nearly in line with the trail, the gunner commands: 1. *Limber,* 2. **HALT.** The limber halts and is then swung around and again halted so that the pole is pointing in the direction of the trail and so that the pintle is almost over the lunette. As soon as the limber has halted in this position, the gunner and No. 1 spring to the trail handles and raise the trail. Nos. 2 and 3 jump to the gun wheels and prepare to assist in any movements of

the carriage that may be necessary. The gunner and No. 1 place the lunette over the pintle; the gunner latches the pintle.

The caisson is limbered in the same manner, No. 4 giving the commands for halting the limber; Nos. 4 and 5 handling the trail; No. 4 latching the pintle; Nos. 6 and 7 assisting by working on the wheels in any movements of the carriage.

All the cannoneers take their posts at the carriages limbered.

59. To the rear: 1. *Limber,* 2. **REAR.**

No. 4 releases the brake. The caisson is turned around 180°; Nos. 4 and 5 carrying the trail away from the piece. Nos. 1 and 6 turn the top of their wheel toward the trail; Nos. 3 and 7 turn the top of their wheel away from the trail; the gunner and No. 2 assist by pulling and pushing on the chest. The caisson having been turned, all the cannoneers working together run the caisson 20 yards straight to the rear of the line of guns. Nos. 4 and 5 lower the trail and all the cannoneers take their posts for limbering. The limbers are brought up and the limbering is completed as described in paragraph 58.

To Leave the Park.

60. At the conclusion of the instruction in the park the instructor sees that the carriages are properly cared for and then causes the squads to form in front or rear of their carriages. The squads may then be closed by the command: 1. **Squads right (left),** 2. **MARCH,** 3.

Close, 4. MARCH. At the last command the leading squad halts and the rear squads close on it in quick time and halt. If executed in double time, the leading squad resumes or continues the quick time at the last command and the other squads take the quick time when they are closed.

Or, the squads may be faced to the right or left. At the command: 1. **Close, 2. MARCH,** the leading squad stands fast and the others close on it.

After forming the squad column the men are marched off.

Preparation for Action and March Order.

To Prepare for Action.

61. The carriages being in position unlimbered: **PREPARE FOR ACTION.**

Each member of the gun squad performs his duties in the order given below:

Gunner: (*a*) Removes the hood from the sight bracket;

(*b*) Releases the traversing and elevating lock and operates the traversing and elevating gear;

(*c*) Removes the sight shank from its case and places it in its socket, setting the range at 3000 and the peep sight at deflection zero;

(*d*) Takes the panoramic sight from its case and places it in its seat, making sure that the sight is clamped and that the deflection is set at zero;

(*e*) Raises and secures the top shield, with the assistance of No. 1;

(*f*) Seats himself on his seat.

No. 1: (*a*) Removes the quadrant from its case and places it in its seat; centers the cross level bubble;

(*b*) Sets the range at 3000 and the site at 300, and brings the range bubble to the center;

(*c*) Equips himself with a lanyard and a wiping cloth;

(*d*) Operates the breech mechanism, examines the breech block, bore, and chamber, cleaning any parts requiring it, leaving the breech open, except when the gun is loaded;

(*e*) Assists the gunner in raising and securing the top shield;

(*f*) Seats himself on his seat.

No. 2: (*a*) Removes the breech cover;

(*b*) Turns back the trail handspike and engages it;

(*c*) Runs around to the right of the piece and assists No. 3 to lower the piece apron;

(*d*) Distributes tow or waste to the cannoneers for use in their ears;

(*e*) Seats himself on the handspike.

No. 3: (*a*) Runs around the left of the caisson and removes the muzzle cover;

(*b*) Removes the front sight cover and adjusts the sight in its firing position;

(*c*) Lowers the piece apron, with the assistance of No. 2;

(*d*) Seats himself at the fuze setter, with his back to the right caisson wheel;

(*e*) Sets his scales at corrector 30, range 3000.

No. 4: (*a*) Assisted by No. 5, lowers the caisson apron;

(*b*) Lowers the fuze setter;

(*c*) Assisted by No. 5, raises the caisson door;

(*d*) Stands ready to serve ammunition.

No. 5: (*a*) Assists No. 4 to lower the caisson apron;

(*b*) Assists No. 4 to raise the caisson door;

(*c*) Puts a round of shrapnel in the fuze setter, setting the fuze;

(*d*) Stands ready to serve ammunition.

The cannoneers report to their chief of section if any parts of the matériel are not in working order.

62. The carriages, limbered, are habitually prepared for action before reaching the firing position. The duties of the cannoneers are the same as at the carriages unlimbered, except that after the examination of the elevating and traversing gear the piece is secured by the traveling lock; the trail handspike is not turned back; the breech is closed; the firing pin is released; the fuze setter is not lowered, nor is a round put in the fuze setter; the apron is not lowered; the caisson door is left closed; and the cannoneers do not take their posts for serving the gun. The gunner and No. 1 return the panoramic sight and the quadrant to their cases, unless special orders to the contrary are given.

Immediately after establishing the carriages the

preparation for action is completed without command and the cannoneers take their posts for serving the piece.

63. If prepare for action has not been given before establishing the carriages in the firing position, that command is habitually given by each chief of section as soon as his carriages have been unlimbered and established. The instructor may caution do not prepare for action when he wishes to drill the personnel in limbering and unlimbering only or in the details of preparation for action.

To Move by Hand the Carriage Unlimbered.

64. 1. **Pieces (Caissons) forward (backward),** 2. **MARCH,** 3. **HALT.**

Each piece: The gunner and No. 2 grasp the trail handles, the gunner the left, No. 2 the right handle; Nos. 1 and 3 the right and left wheels, respectively; Nos. 4 and 5 place themselves so as to work advantageously at the breech of the gun in moving forward, at the muzzle in moving backward. Nos. 6 and 7 assist at the nearest wheels. At the command **march,** all working together move the carriage in the direction indicated. At the command **halt,** they stop the carriage and resume their posts.

Each caisson: Executed as explained for the piece, except that Nos. 4 and 5 are at the trail of the caisson and that the gunner and No. 2 work in rear of the caisson chest in moving to the front, against the footboards in moving to the rear.

Posts of the Cannoneers, Carriages Unlimbered and Prepared for Action.

65. In each squad, the gunner, seated on his seat facing the gun.

No. 1, seated astride his seat facing the gun.

No. 2, seated astride the trail handspike near the trail.

No. 3, seated with his back to the inside of the right caisson wheel, facing the bracket fuze setter, legs extended one on each side of the fuze setter.

Nos. 4 and 5, in rear of the caisson in a convenient position for the performance of their duties.

Nos. 6 and 7, abreast and in order from right to left, 5 yards in rear of the trail spade of their piece, awaiting orders.

Higher numbered cannoneers, if present, accompany the limbers.

In the Horse Artillery the two highest numbered cannoneers act as horse holders and take the led horses to the rear with the limbers.

To Resume the Order for Marching.

66. The carriages being prepared for action, to resume the order for marching: **MARCH ORDER.**

Each member of the gun squad performs his duties in the order given below:

Gunner: (*a*) Lowers and secures the top shield, with the assistance of No. 1;

(*b*) Sees that deflection reading is zero, returns panoramic sight to its case and secures case;

(*c*) Replaces the cover on the sight shank and returns it to the trail box;
(*d*) Traverses and elevates the piece to the traveling position and fastens the traveling lock;
(*e*) Secures the hood over the sight bracket;
(*f*) Takes his post.

No. 1: (*a*) Assists the gunner in lowering and securing the top shield;
(*b*) Closes the breech; releases the firing pin;
(*c*) Returns the lanyard and wiping cloth to the trail box;
(*d*) Sets the range at 3000 and the site at 300;
(*e*) Returns the quadrant to its case and secures the case;
(*f*) Takes his post.

No. 2: (*a*) Assists No. 3 to raise and secure the piece apron;
(*b*) Turns down and secures the trail handspike;
(*c*) Replaces the breech cover and secures it;
(*d*) Takes his post.

No. 3: (*a*) Sees that the fuze of any round whose fuze has been set is set back at safety;
(*b*) Sets fuze setter at range 3000, corrector 30;
(*c*) Raises and secures the piece apron, with the assistance of No. 2;
(*d*) Replaces the front-sight cover and adjusts the front sight in the traveling position;
(*e*) Replaces and secures the muzzle cover;
(*f*) Takes his post.

No. 4: (*a*) Assists in setting fuzes back at safety;
(*b*) Passes the round to No. 5;
(*c*) Assisted by No. 5, lowers and secures the caisson door;
(*d*) Raises and secures the fuze setter;
(*e*) Assisted by No. 5, raises and secures the caisson apron;
(*f*) Takes his post.

No. 5: (*a*) Receives ammunition from No. 4 and stores it in the chest;
(*b*) Assists No 4 to lower and secure the caisson door;
(*c*) Assists No. 4 to raise and secure the caisson apron;
(*d*) Takes his post.

If it is intended to resume the fire, but in another position, so that the limbering of the carriage is necessitated, the command **MARCH ORDER** is not given. At the command for limbering the carriages are placed in the order described in paragraph 62.

67. If the situation is such as to make it probable that the guns will have to defend themselves from close attack the command **sights for fire at will** may be added either to the command for preparation for action or to that for resuming the march order. At such command, the gunner sets deflection zero, range 1000; No. 3 sets the corrector 30, range zero.

ORGANIZATION OF THE BATTERY.

68. The **battery,** as organized on a war footing, is composed of nine sections with matériel and supply section. It is commanded by the **captain.**

The first four sections are gun sections. The next four sections are caisson sections. The ninth section comprises the battery wagon and forge, the store wagon and at least one pair of harnessed wheel horses and one pair of harnessed lead horses. The supply section has no matériel and is composed of the mess sergeant and the cooks. In the field, the supply section is assigned to the regimental field train.

A **gun section** consists of a gun and its caisson, manned, horsed and equipped.

A **caisson section** consists of two caissons, manned, horsed and equipped. The leading caisson of each caisson section in the normal order in park is called the **first caisson**; the other is called the **second caisson.**

Two sections constitute a **Platoon.**

69. The first platoon is commanded by the **executive**; the second platoon by the **assistant to the executive**; the third platoon by the **reconnaissance officer,** when that officer is not otherwise employed; and the fourth platoon by the **lieutenant** in charge of **Department B.**

The **first sergeant** is assistant to the captain, and is responsible to him for the general good order, police, and discipline of the battery.

The **stable sergeant** is responsible for the general

care of the public animals assigned to the battery and the good order and police of the stables, picket lines, etc.

The **supply sergeant** is responsible for all the government property issued to the battery.

The **mess sergeant** is responsible for the proper messing of the battery.

The **chief mechanic** is responsible for the good order and repair of the matériel in actual use by the battery. In action he assists the executive.

The **sergeants** command sections.

The **gunners** are responsible for the good order of their guns, carriages, limbers, and equipment.

Each **caisson corporal** is placed in charge of a caisson, and acts as assistant to his chief of section.

70. On subdivision for action the battery is divided into the **firing battery** and the **combat train.** The firing battery comprises the first five sections. It is under the immediate command of the captain, who is assisted by the executive and the assistant to the executive. The combat train comprises the sixth, seventh, eighth, and ninth sections. It is commanded by the lieutenant in charge of Department B, who is assisted by the stable sergeant. The reconnaissance officer assists the battery commander with the battery detail.

71. On a peace footing the sixth, seventh and eighth sections are not manned or horsed. Otherwise the organization is similar to that on a war footing.

72. For efficient administration and instruction, the duties in a battery of Field Artillery are too numerous

to be efficiently supervised in detail by one officer. To secure such supervision the battery commander must utilize the services of his lieutenants. The most effective assistance will not be obtained by simply holding a lieutenant responsible for a platoon, because in the Field Artillery the platoon is not a self-sustaining unit but one dependent upon agencies outside itself. The assignment of lieutenants to their duties of administration and instruction must be made so as to correspond to the various duties which come up in the daily existence of the battery as a whole. These duties may be classified into three departments:—

Department A: The care and maintenance of all parts of the wheeled matériel. All instruction with the guns.

Department B: The care of animals; the inspection, care and issue of forage; the police of stables and the picket lines; the adjustment and care of harness, shoeing, etc. All mounted instruction.

Department C: The care and police of quarters; the superintendence of the battery mess, personal equipment and clothing, and of the routine office work. All dismounted and special instruction.

The fourth lieutenant, when available, is ordinarily the one with least experience as a battery officer. He should be utilized in assisting the others and should be required to thoroughly familiarize himself with their

work, preparatory to his assignment to one of the departments.

In time of war the captain assigns his lieutenants to the departments to which they are best fitted, the especial fitness of the executive being the first consideration.

In time of peace, however, in order that the experience of lieutenants in administration, and in the instruction and training of men and animals may be complete, their assignment to departments must be periodically changed.

Composition, Formation, and Instruction of the Firing Battery.

73. **The firing battery** comprises the guns and caissons of the first five sections of the battery, with the personnel and animals assigned to their immediate service. It is under the direct command, or order, of the captain. The most suitable lieutenant of the battery is selected for the immediate command of the firing battery when the battery commander is at some distance from the guns, and for the immediate supervision of the gun squads when the battery commander is near enough to the guns to give his orders and commands by word of mouth. This lieutenant is the **executive.** When the number of lieutenants present permits, the executive has a junior lieutenant assigned to him as assistant.

74. In the field it is desirable that the guns be placed approximately in line with regular intervals of approximately 17 yards between adjacent gun wheels. It is more important that the intervals be regular than that they be exactly 17 yards. Each chief of section cautions (**Such**) **piece,** or, **No.** (**So-and-so**), as soon as his carriages have been established in position.

In the park the limbered carriages are formed in line or column of double sections, the caisson of each section being alongside of and at two yards interval from its piece, at such intervals or distances between sections as may be practicable. By the execution of **action front** (**rear, right,** or **left**) the carriages are placed in line in the firing position at sufficient intervals for the drill of the gun squads.

75. At the commencement of training of recruits in their duties in the firing battery, their instruction in the elementary principles of gunnery contained in this chapter will be begun. As the instruction progresses and the recruits are divided into classes, each class should be instructed in so much of the principles involved in **Service Firing** as the men of the particular class can thoroughly grasp.

Duties in General of Officers of the Firing Battery and of the Noncommissioned Officers of the Gun Sections.

76. Captain:

Commands the firing battery and, as a rule, conducts the fire.

77. **The executive:**

1. Usually conducts the firing battery to and establishes it in the firing position. Causes such measures to be taken as will facilitate the rapid opening of accurate fire. Sees to the preparation of all practicable protection for the personnel in addition to that provided by the shields.

2. Exercises immediate command of, or supervision over, the battery in the firing position.

3. Repeats all firing data when the captain is not near enough the battery to command it by voice.

4. Gives the command for commencing firing whether the captain be at the battery or not. The command by the executive is **Fire.** It is usually accompanied by a signal made by bringing the extended right arm from a vertical position sharply to the side. For salvos the executive gives the command **fire** as soon as he sees that all the pieces will be ready to fire in their proper turn. For volleys he may give the command **fire** immediately after the range has been announced or he may wait until all the pieces are ready, according to the instructions of the captain.

5. Assisted by the chief mechanic attends to the resupply of ammunition, under such general instructions as the captain may give.

6. Has charge of the replacement of casualties.

78. **Assistant to the executive:**

Assists the executive in the supervision of the gun

sections, especially when difficulties or errors occur in a gun squad.

79. Chief of gun section:

1. Commands his section.

2. Makes sure of the identification of his part of the target or of the aiming point.

3. Keeps informed of the firing data so as to be able to repeat any parts not understood by the cannoneers, but does not repeat anything unless it is called for by a subordinate. If a chief of section does not understand any item of the firing data he asks the executive for it thus: Site? Corrector? etc.

4. In indirect laying whenever the trail has to be shifted, puts the gunner approximately on the aiming point by glancing along one side of the rotating head of the panoramic sight and causing the trail to be shifted until the side of the rotating head is in line with the aiming point.

5. Commands **with the lanyard** for the first shot when the ground is such that the trail spade is not easily seated, and sees that all the cannoneers step clear of the piece for the first shot.

6. Extends his right arm vertically as soon as the gunner has called **ready,** so as to indicate to the executive officer that the piece is ready to fire. The right arm is held vertical until his gunner commands **fire.**

7. Supervises and is responsible for all the details of correct service by his gun squad.

80. **Gunner:**

1. Performs his duties in the gun squad.

2. Commands **muzzle right (left)** when he has reached the limit of traverse of the gun on the carriage.

3. Commands **fire** so that his piece will be fired, **after having been accurately laid,** at the proper time.

Measures for Facilitating the Rapid Opening of Fire.

81. Early opening of effective fire is facilitated by accurate establishment of the firing battery in the firing position without undue haste or confusion. To this end all officers, noncommissioned officers, and men will take particular care that the carriages are regularly and methodically established and quickly prepared for action. Commands are to be given by the proper individuals. Unnecessary conversations and laxity in the work of getting the guns into position lead to delay and poor fire discipline.

82. If fire is not to be opened immediately upon occupying the position, a semicircular trench should be dug for the trail spade. If fire is opened at once it is always advisable to dig such a trench during the lulls in firing. Such a measure gives great facility in shifting the trail and is especially valuable in firing at moving targets.

83. The targets for light field guns are most frequently at a site of about 300 and at ranges near 3000 yards. Hence the setting of sights, quadrants, and fuze setters at **Site 300, Corrector 30, Range 3000,** in

the absence of exact data, and the leveling of instruments tend to hasten the opening of fire. If indirect laying is to be used the aiming point is usually known as soon as the carriages are unlimbered.

Since the front of the battery is usually established about perpendicular to the direction in which fire is to be delivered, the head of the panoramic sight should be turned on the aiming point as soon as the gun, prepared for action, is fully established in its position.

It is frequently practicable to communicate most of the firing data and to set the instruments before occupying a position, or at least some time before the fire is to be opened.

If no target is visible or none has been assigned to the battery when the position is occupied, the captain selects a prominent point near the center of the sector he is to cover and causes the guns to be laid upon it.

Deflection and Deflection Difference.

84. Each gun in the battery must be so pointed that its projectile will fall in the direction of its part of the target.

85. The direction of each gun may be given by setting the sight at zero, then bringing the cross hairs on the target by shifting the trail and traversing the gun on the carriage. This is called *direct laying.*

Or, the direction of the gun may be given by setting the sight at a reading, called the deflection previously determined, and then bringing the vertical cross hair

on a designated aiming point by shifting the trail and traversing the gun on its carriage. This is called *indirect laying.*

86. When the guns are laid for direction by bringing the cross hairs on the target, each gunner sights at and his projectiles should fall on his own part of the target.

When the guns are laid for direction by bringing the vertical cross hairs on an aiming point it is usually necessary to give the guns different deflections in order that each piece may be brought on its own part of the target. The difference in deflections is called the **deflection difference.** It is usually small and is the same for any two adjacent pieces.

87. By **opening out** the guns like a fan, the front covered by the fire is increased; by **closing in** the guns, the front covered may be decreased. By increasing or diminishing the deflection difference, therefore, the front on which the projectiles fall may be increased or decreased at will.

The lines of fire of several pieces collectively directed form the **sheaf of fire.**

88. When an aiming point is used, the captain, assisted by his battery detail, determines the deflection for one of the pieces and the amount by which the other pieces must be opened out or closed in on this one in order that the shots may fall on the front desired.

The piece for which the deflection is determined or on which the others are to close or open is indicated

by the number of the piece given in the command: **On (such) piece, Open (close) (so much).** This piece is called the **directing piece.**

89. Since the deflection difference for any two adjacent pieces is the same, each gunner must multiply the deflection difference by the number of gun intervals between his piece and the directing piece in order to find the amount by which his deflection will differ from that of the directing piece.

90. The gunner of the directing piece does not change his deflection on account of the deflection difference.

In order to open out the sheaf the guns on the right of the directing piece must have their muzzles moved to the right and those on the left of the directing piece must have their muzzles moved to the left.

91. This is accomplished by turning the top of the worm knob of the panoramic sight to the right to move the muzzle to the right or to the left to move the muzzle to the left.

The gunner must multiply the deflection difference by one, two, or three, depending on the number of guns his gun is to the right or left of the directing gun, and change his deflection reading in the appropriate sum by this amount.

92. When the aiming point is in certain positions it may happen that the fire will be properly distributed on the target when the deflection of all the pieces is the same, or when the deflection difference is zero. The

absence of any command **open** or **close** is the indication that all the pieces are to be laid with the same deflection.

93. After the first or subsequent firing, one of the guns may be directed on its part of the target while the others are not. In such cases the captain does not change the deflection, but brings all the guns on the target by opening or closing on the gun which has the proper direction.

94. The gunners are trained in setting off the corrected deflection individually as well as during the instruction of the gun squads.

For example: 1. **Deflection 1620, 2. On 1st piece, Open 10.** All the gunners set 1620 as soon as it is announced. As soon as **On 1st piece, Open 10** is given the gunner of the 2d piece multiplies 10 by his interval (one) and adds the result (10) to 1620, and accordingly sets 1630. The gunner of the 3d piece multiplies 10 by his interval (two) and adds the result (20) to 1620, and accordingly sets 1640. The gunner of the 4th piece multiplies 10 by his interval (three) and adds the result (30) to 1620, and accordingly sets 1650.

The sights being set as above, for example, the command may be: **On 3d piece, Close 5.** The third piece becomes the directing piece and its gunner leaves his sight reading at 1640. The gunner of the 4th piece multiplies 5 by his interval (one), subtracts the result (5) from 1650, and accordingly sets 1645. The gunner of the 2d piece multiplies his interval (one) by 5, adds the result (5) to 1630, and accordingly sets 1635. The

gunner of the 1st piece multiplies his interval (two) by 5, adds the result (10) to 1620, and accordingly sets 1630.

95. It is most important that all the gunners **first** set the deflection ordered and **then** apply the deflection difference. This method avoids errors and results in greater rapidity than is obtained should the gunner attempt to make all of his calculations and then to set off the resulting deflection.

96. It may be that the aiming point can be seen from only one piece. In such cases the executive, after announcing the deflection, commands: **Lay on (Such) piece,** designating the piece from which the aiming point can be seen. At this command each chief of section, except that of the piece designated, causes his gunner to turn his sight in the direction of the designated piece and his No. 2 to extend the rammer staff vertically in front of the object glass of the sight. The designated piece having been accurately laid at the indicated deflection, its chief of section causes the gunner to turn his sight, **without traversing the piece,** so that the vertical hair will bisect the rammer staff at the other pieces in succession and announces the reading, thus: **No. (So and so), (So much).** The chief of section of the piece which can see the aiming point then causes No. 2 to extend his rammer staff vertically alongside the sight.

As the reading for his piece is called off, each chief of section who is unable to see the aiming point sub-

tracts 3200 from the reading announced if he is on the left of the piece from which the aiming point can be seen, or adds 3200 to the reading if he is on the right. He then causes the gunner to set his sight according to the result thus obtained and to lay on the rammer staff at the designated piece. This results in the guns being laid so that the axes of the bores are parallel.

Each chief of section then selects his own aiming point and causes the gunner to measure the deflection.

97. The necessity for taking full advantage of cover for the concealment of the guns, especially from aircraft, may sometimes make it impossible to utilize a common aiming point or to see one piece from another. In such cases the executive causes the pieces to be pointed, by the compass or other means, as nearly as may be in the proper direction. One of the pieces is selected to fire a single round of time shrapnel so as to give a burst about 10 mils above the horizon visible from the guns and at as great a range as practicable. The remaining pieces are so elevated and the sights are so set as to enable each gunner quickly to turn the rotating head of his panoramic sight upon the burst without disturbing the laying of the piece. Each chief of section, having noted the deflection, causes the gunner to turn the sight on any suitable aiming point without disturbing the laying. The reading on the aiming point selected is then diminished by the reading on the burst if this latter reading was less than 3200. If the reading on

the burst was greater than 3200 the reading on the selected aiming point is increased by the difference between the burst setting and 6400. The deflection obtained by making the corrections just indicated is then set off on each sight and each gunner brings his cross hairs on the aiming point selected by traversing the piece. This results in the pieces all being laid on the point of burst of the shot fired. By suitable commands for opening the captain forms the sheaf.

98. Having once formed the sheaf, the captain may change its direction by announcing a new deflection or by the command: **Right (Left), (So much).** At the command, for example, **Right 30,** each gunner **subtracts** 30 from his deflection, sets his sight at the new deflection, and brings his vertical cross hair on the aiming point by traversing the piece. Each gunner has then moved the muzzle of his gun to the **right** through an angle of 30 mils. Similarly, if the command be **Left 30** each gunner **adds** 30.

99. The direction and distribution may be changed simultaneously. At the command, for example, **1. Left 30, 2. On 1st piece, Close 5,** each gunner first adds 30, and then applies the deflection difference. Having set off his correct deflection, each gunner brings his vertical cross hair on the aiming point by traversing the piece.

100. In order properly to distribute the fire, it is sometimes necessary to change the deflection of a single piece while leaving the others unchanged. The

captain commands, for example, **(Such) piece, Right (left), (So much).** The deflection of the designated piece only is changed as indicated in the command.

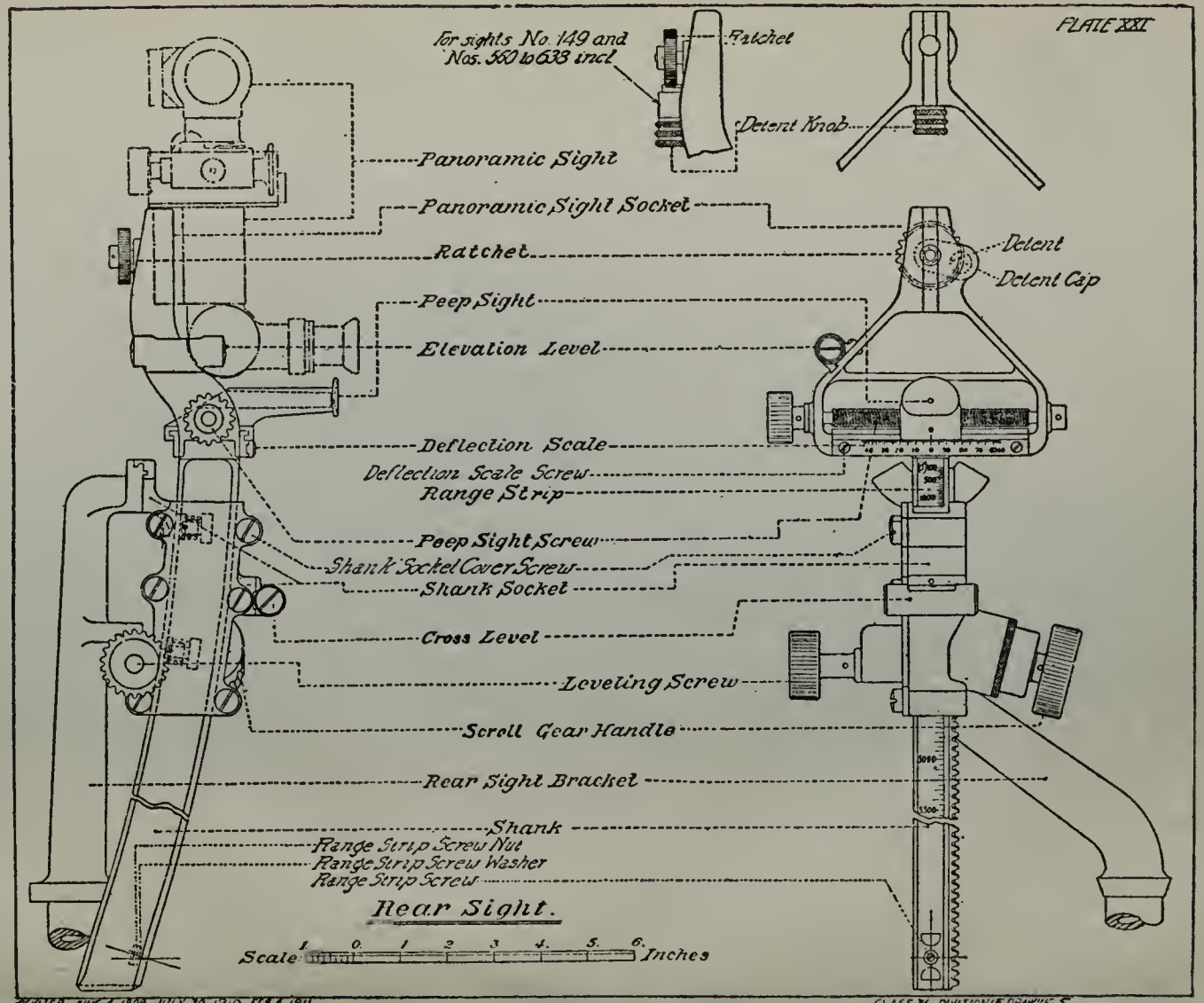
Range and Site.

101. As the distance from the guns to the target increases the guns must be pointed more and more above the line joining the gun and the target in order that the projectile may reach the target.

102. Since targets are not always at the level of the gun, but are frequently above or below this level, the actual inclination of the gun to the horizontal when the gun is laid on a target is not the elevation due to range of the target only, but is a combination of this elevation due to range and of the difference of level between the target and the gun. When the gunner sets his sight shank at the correct range and, looking through the sight, brings the horizontal hair on the bottom of the target, he automatically gives the gun the correct elevation above the line joining the gun and the target. This elevation of the gun above the line from the gun to the target is affected by the range only, and does not vary with the height of the target.

103. When the gunner does not sight directly at the target, but lays the gun for direction by sighting at an aiming point, the gun elevation must be given by the quadrant. The quadrant, therefore, has devices by which the angular elevation due to range may be set off and by which allowance for the difference in level between the gun and the target may be made.

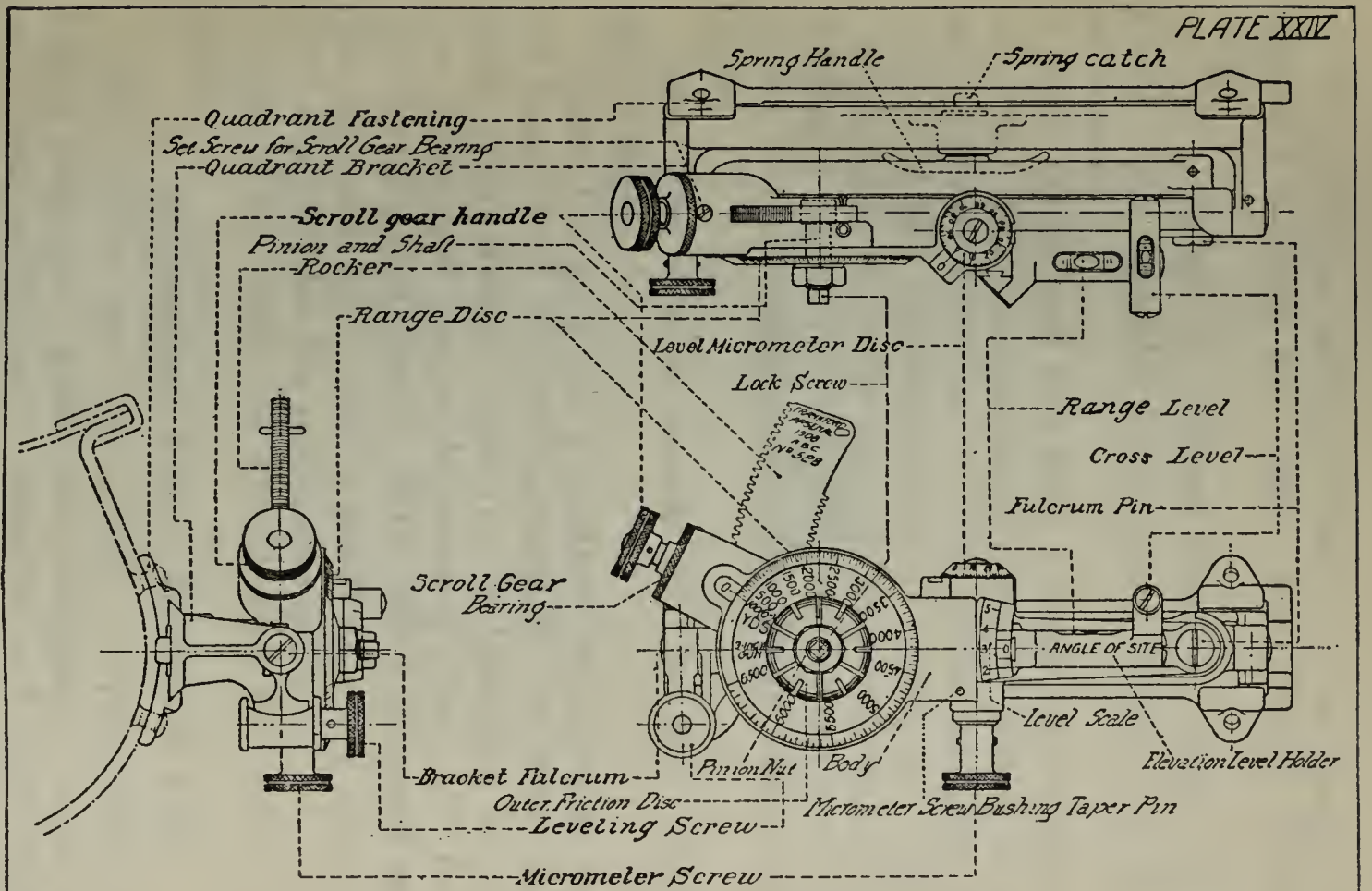
PLATE XXI



REVISED JUNE 4, 1908, JULY 30, 1910. FEB 6, 1911

CLASS 36-DIVISION 5 DRAWING 5

PLATE XXIV



Range Quadrant

Scale 1 0 1 2 3 4 5 6 Inches

REVISED JUNE 4, 1908, JULY 30, 1910. FEB 6, 1911.

CLASS 36-DIVISION 22 DRAWING 5

The first is accomplished by the range disk, the operator setting the range announced opposite the index.

The second is accomplished by the site device, which the operator has only to set at the value announced.

The range and site data having been set off on the quadrant and the quadrant being in place on the gun, the operator elevates or depresses the gun until the bubble of the elevation level is centered. The proper combination of these two angular values is thus automatically made and the gun has the proper inclination to the horizontal to cause the projectile to reach the target.

104. The site is announced by the captain, **Site (So and so).**

Since the guns of a battery are usually on nearly the same level, the site is usually the same for all the guns. Sometimes, however, it becomes necessary to give a different site to the several guns. In such cases the captain commands: **Site, No. 1 (So and so), No. 2 (So and so),** etc. The gunner of each piece sets the site indicated for his particular piece.

105. The range is announced for each salvo or volley.

Projectiles, Fuzes, Kinds of Fire.

106. There are two kinds of projectiles for the 3-inch field gun: **shell** and **shrapnel.** There are also two kinds of shrapnel: **common** and **high explosive.**

107. The **shell** consists of a steel case with a bursting charge of high explosive which detonates upon striking.

The **common shrapnel** consists of a steel case containing about 250 bullets and a bursting charge of black powder in the base.

The **high-explosive shrapnel** (H. E. shrapnel) is similar to the common shrapnel, except that it contains not only the base charge but a high explosive intermingled with the shrapnel bullets. This shrapnel is fitted with a fuze that causes the high explosive to detonate upon striking. (See plate V.)

If either the common or the high-explosive shrapnel bursts in air the case is not ruptured, but the base charge forces the nose off the shrapnel case and expels the bullets to the front in the general shape of a cone, called the **shrapnel cone.**

108. With respect to the instant at which the projectiles burst, fire is classified as **percussion** fire and **time** fire.

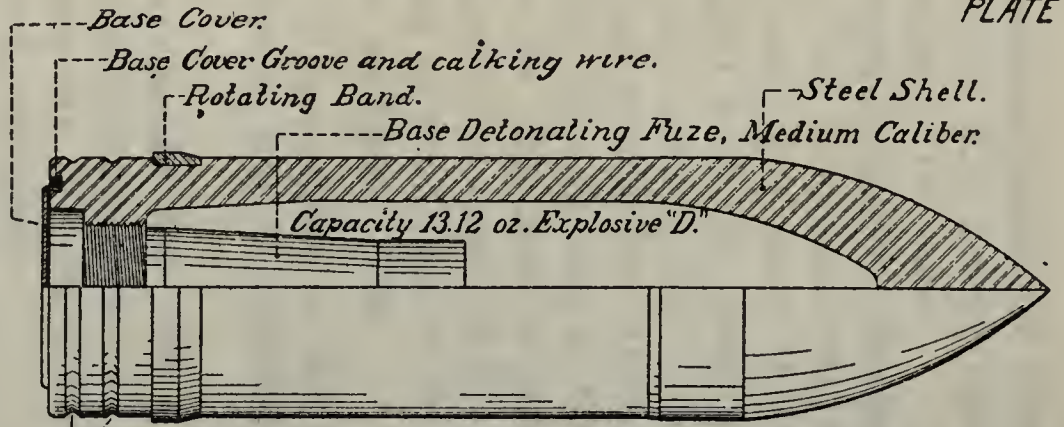
In **percussion** fire the projectile bursts when it strikes; the burst is then said to be **on impact.**

In **time** fire the projectile bursts in the air before reaching the ground.

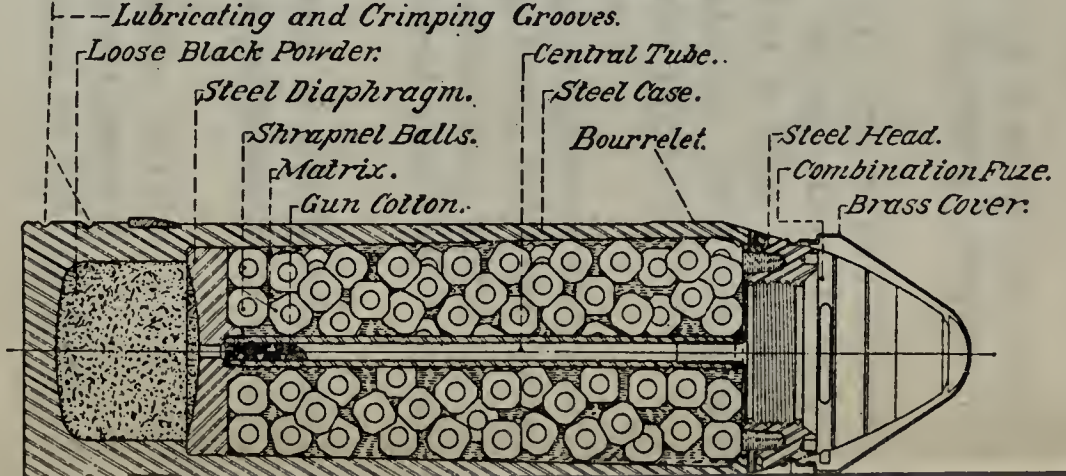
109. Bursts on impact are secured by a fuze which explodes the bursting charge upon striking. Such a fuze is a **percussion** fuze. It does not have to be set, but is always ready to act after the projectile is fired.

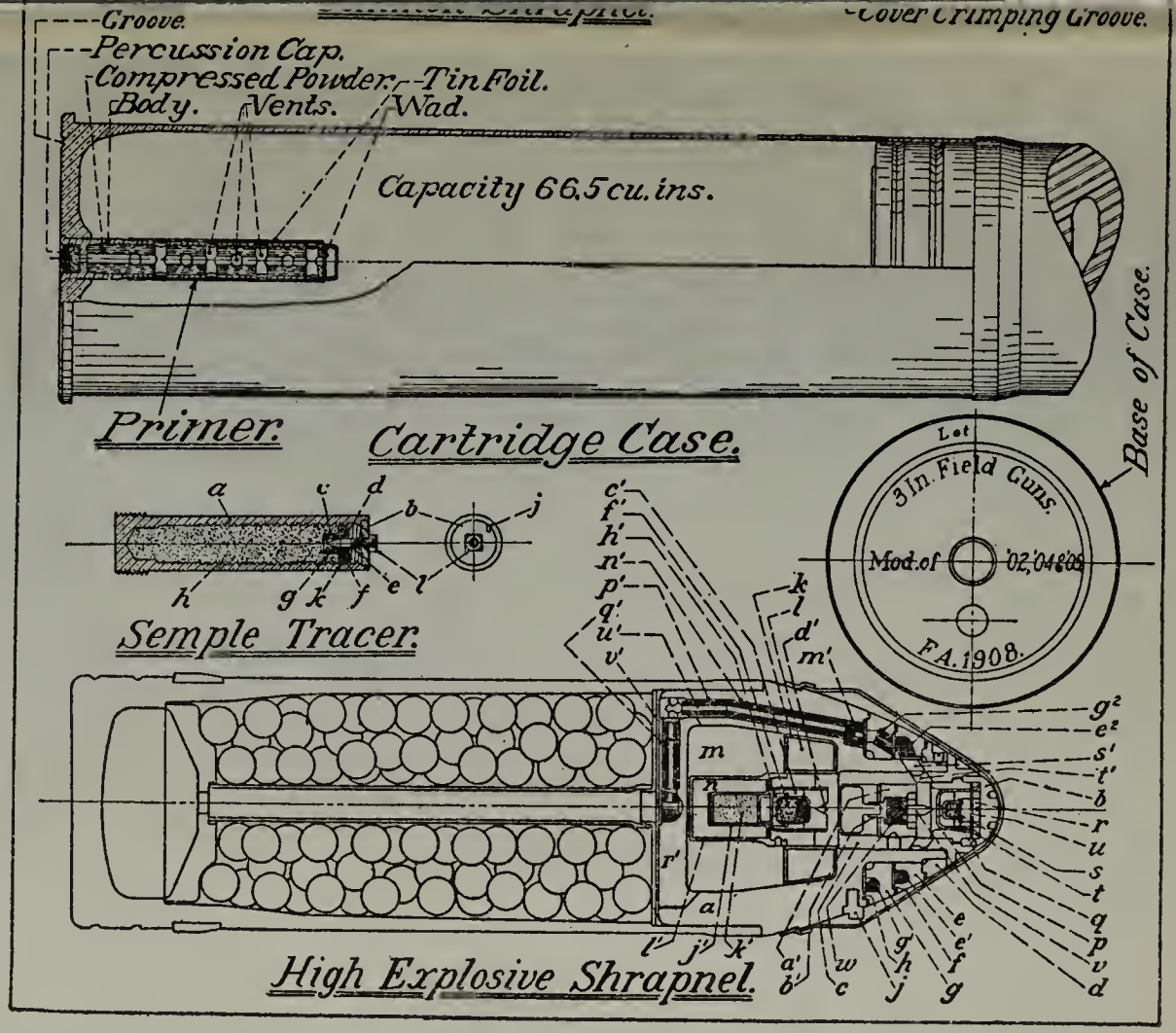
110. Bursts in the air are secured by a fuze which

PLATE V



Common Steel Shell.




Groove.
Percussion Cap.
Compressed Powder.
Tin Foil.
Body.
Vents.
Wad.
Capacity 66.5 cu. ins.
Base of Case.
Primer.
Cartridge Case.
Lot
3 In. Field Guns.
Mod. of '02, '04 & '08
F.A. 1908.
Semple Tracer.
High Explosive Shrapnel.

can be set to explode the base charge at any time after the projectile is fired. Such a fuze is a **time** fuze. It contains a powder train which starts burning at the instant when the projectile is fired and, when the fuze is set, burns down to the base charge in a period of time dependent on the setting.

111. For convenience the fuze setter for setting the time fuze is graduated in range. But due to errors of the fuze and other causes the base charge will not always explode at exactly the range set off. Moreover, it is sometimes necessary to vary the height of burst. For this the fuze setter is arranged to permit changing the fuze setting without changing the range reading on the fuze setter. The device for accomplishing this is called **the corrector.** A corrector of about 30 ordinarily gives a height of burst of about 3 mils as seen from the guns. This height of burst is called **normal.** Raising the corrector **shortens** the part of the time train which must burn before the base charge is reached and therefore **raises** the height of burst. Lowering the corrector **lengthens** the time of burning and **lowers** the height of burst.

112. All shells are provided with **percussion** fuzes only.

All shrapnel are provided with **combination** fuzes containing both percussion and time elements. The percussion element acts if the time element has not acted before the projectile strikes. If the combination fuze be set at safety the time element can not act, but the percussion element will act.

113. The gun squads must know the kind of projectiles and the fuze which are to be used. This is indicated to them by the commands: **Shell**; or, **Percussion**; or, **Corrector (So much)**; or, **Up (Down) (So much)**. The command **shell** indicates that shell are to be used. Since shrapnel for percussion fire must have their fuzes set at safety and since the fuzes are carried at that setting in the chest, it is not necessary to use the fuze setter when the command **percussion** is given; but, as the gun squads must be ready to change from percussion to time fire, No. 3 always sets his range scale at the last range announced.

Corrector (So much); or, **Up (Down) (So much)** indicates time fire with shrapnel and that the fuzes must be set.

114. A circular groove is cut in the base of the cartridge case. The groove is painted red for high-explosive shrapnel, yellow for common shrapnel, and black for high-explosive shell. A circular hole 0.02 inch deep and 0.375 inch diameter is drilled in the base of the cartridge case and filled with red paint for common shrapnel fitted with Semple night tracers and with black paint for day tracers.

Methods of Fire.

115. The methods of fire are fire by salvo, volley fire, volley-fire sweeping, and fire at will. The use of salvos and volleys is habitual and both natures of fire are ordinarily used in firing at each target, particularly in time fire. Volley-fire sweeping is employed during

fire for effect. Fire at will is exceptional, being used only for the close defense of the guns.

Salvos.

116. The command for a battery salvo is: **Battery right (left).** Upon the command **fire** by the executive the pieces are fired, at the command of the gunners, in order from the right at intervals of about two seconds.

117. The command for a platoon salvo is: **Right right (left),** or, **Left left (right).**

The first word of the command designates the platoon which is to fire.

If the command be **right right (left)** the first and second pieces only are loaded. Similarly, if the command be **left left (right)** the third and fourth pieces only are loaded.

The second word of the command indicates the flank from which the pieces designated are to be successively fired. Upon the command **fire,** by the executive, the pieces designated are fired, at the command of their gunners, in the order indicated at an interval of about two seconds.

118. The interval of two seconds may be increased by cautioning after the command for the salvo, **At (so many seconds).** The interval thus prescribed will be used as long as salvos are fired until another interval is announced.

119. Occasionally it may be desirable to fire each piece at the specific command of the captain. The captain cautions: **At my command.** Each piece is then

fired upon the command by the captain: **No. (So-and-so) Fire**, each gunner repeating the command **fire** when his piece is designated.

120. In certain cases it may be desirable to fire a single piece. The captain commands: **(Such) piece only.** The designated piece only is loaded and it is fired upon the command **fire** by the executive.

121. When the method of fire is by platoon salvo or by piece, the gun squads of the pieces which are not to take part in the firing keep all the instruments set and the pieces laid in accordance with the commands. All the guns are thus able to open fire immediately. To change from platoon salvos, or fire by single piece, to battery salvos, the command is: **Battery right (left).** All of the pieces take up the fire in succession from the flank indicated.

122. Salvos are particularly suitable for fire for adjustment on account of the facility with which the bursts may be observed.

Volley Fire.

123. The command for battery volleys is: **Battery (So many) rounds.** Upon the command **fire** by the executive, each piece fires the designated number of rounds as rapidly as possible consistent with accuracy and without regard to the other pieces. To make certain that the correct number of rounds is fired, each No. 4 as he loads the piece calls out the range and the number of the round. As the last round ordered is loaded, he adds: **Last round.** Thus, the command being

Battery 2 rounds, 3200. On loading the first round, each No. 4 calls **3200, One;** on loading the second round, each No. 4 calls **3200, Two, Last round.**

124. In exceptional cases it may be desirable to use one platoon only in volley fire. In such cases the command is: **Right (Left), (So many) rounds.** Only the pieces in the designated platoon are loaded and fired.

125. Volley fire is particularly suitable for fire for effect on account of the rapidity with which it may be delivered.

Volley-fire Sweeping.

126. The purpose of sweeping is to distribute the fire over a wide front. It consists in changing the direction of each piece between shots.

This may be accomplished mechanically by a full turn of the traversing hand-wheel between rounds if there is not material lost motion in the mechanism. Or, if the reticule of the panoramic sight is provided with a horizontal scale, the line of sight may be shifted through an appropriate angle.

127. The commands for sweeping are: **Battery (So many) rounds, sweeping,** or, **Right (Left), (So many) rounds, sweeping.** The execution is the same as that of volley fire in every respect, except that after the first and each succeeding round of the sweep the gunner traverses the piece to the left by one full turn of the traversing handwheel, disregarding accurate laying in direction; or, if the reticule of the sight has a horizontal scale, instead of turning the handwheel he shifts the

line of sight 10 mils to the left for ranges up to 2500 yards, 5 mils for ranges exceeding 2500 yards.

As soon as the last round of the sweep has been fired, the gunner traverses the piece back to the right until the line of sight is again on the right of his portion of the target or on the aiming point.

Fire at Will.

128. For the very close defense of the guns the command is: 1. **Target (So-and-so), 2. FIRE AT WILL.** At this command sights are set at deflection zero and range 1000. Fuze setters are set at corrector 30 and range zero. Shrapnel only are used. Each gun is loaded and laid on the target. Upon the command **fire** by the executive, each gun is fired as rapidly as possible until the command **cease firing** or until the target disappears or actually reaches the gun. In fire at will, the gunner neglects all refinements of laying, rapidity in this case being of more importance than great accuracy.

Firing Data and Their Communication to the Gun Squads.

129. **The firing data** embrace all the information and commands necessary to enable the gun squads to accomplish the orderly, rapid, and accurate service of the pieces. To this end it is essential that the firing data be communicated to the guns in an habitual sequence. First place must be given to the element of the data most essential to commencing the service of the pieces. The sequence should favor as far as pos-

sible the completion of one operation by a particular member of the gun squad before he is required to take the data for another.

130. The necessary data for indirect laying in their habitual sequence are—

1. The designation of the aiming point.
2. The deflection.
3. The deflection difference.
4. The site.
5. The kind of projectile (corrector, shell, or percussion shrapnel).
6. The method of fire.
7. The range.
8. The command, by the executive, **fire.**

131. The necessary data for direct laying in their habitual sequence are—

1. The designation of the target.
2. The deflection.
3. The kind of projectile (corrector, shell, or percussion).
4. The method of fire.
5. The range.
6. The command, by the executive, **fire.**

132. Fire at will being an exceptional and special method, in which the sight and the fuze setter have fixed settings, and direct laying with shrapnel is always used, the only firing data necessary are the designation of the target, the method of fire, and the command **fire.**

133. It is generally possible to communicate certain

items of the data before the moment for opening fire. For example, in indirect laying the aiming point may be designated and the approximate deflection and the deflection difference announced as soon as the guns are established.

134. Except when the captain is near enough to the battery to make his voice heard by all the gun squads, the executive repeats all the firing data. Without awaiting any signal or command from the captain, the executive gives the command **fire** at such time after the range is announced as will insure the orderly delivery of the fire. If the captain desires to give a range without opening fire, he cautions **Do not load** before announcing the range. To load and fire he again announces the range. To suspend the fire at any time the captain commands or signals: **Cease firing.** The firing is stopped and all of the pieces are unloaded, but are kept laid with the last data received. The signal for cease firing is a prolonged blast on the whistle with the right arm raised vertically until the signal is obeyed.

135. Each gunner gives the command **fire** so that his piece will be fired at the proper time after the command **fire** by the executive. No other item of the firing data is repeated unless it is called for. When a member of a gun squad does not understand any item of the firing data he asks his chief of section for it, thus **Site? Corrector?** etc.

136. The complete firing data are always necessary before firing the first salvo or volley after occupying a

position. After the first salvo or volley the captain announces only so much of the data as he desires to change, except that the range is always given as a definite signal to load and for the executive to give the command **fire** at the proper time.

In firing shell or percussion shrapnel each piece is loaded as soon as it is fired; but the range is nevertheless given as a definite signal for the executive to give the command **fire** at the proper time.

137. In the exceptional cases in which the captain causes each piece to fire at his command, the executive repeats the command: **No. (So and so) Fire**, unless the captain is near enough to the guns to make his voice heard by all the gun squads. Each gunner cautions **fire** at the proper time.

To Measure a Deflection.

138. The gun being established in direction by direct laying or otherwise, the deflection may be measured by turning the rotating head of the panoramic sight until the vertical cross hair is on the aiming point. The reading of the instrument is then the deflection sought.

139. The gunner is practiced in measuring the deflection as follows:

The gun being laid in direction on any target with zero deflection and the gunner seated on his trail seat, the instructor commands, for example:

1. **Aiming point, that clock tower.**
2. **MEASURE THE DEFLECTION.**

1. The gunner turns the rotating head of the panoramic sight until the vertical cross hair is on the designated aiming point.

2. He then reads and announces the deflection, thus: **Deflection, 490.**

Duties of the Cannoneers.

The Gunner.

140. The duties of the gunner in the service of the piece are:

1. To set the deflection.
2. To apply the deflection difference.
3. To set the range.
4. To level the cross-level bubble on the sight-shank socket.
5. To give the direction to the piece.
6. To give the elevation in direct laying.
7. To call **ready.**
8. To move his head out of the way of the sight before the piece is fired.
9. To give the command to fire the piece.
10. To measure a deflection when directed.

141. **To throw the projectile to the left, increase the deflection. To throw the projectile to the right, diminish the deflection.**

No. 1.

142. The duties of No. 1 in the service of the piece are:

1. To set and release the brake.
2. To open the breech.
3. To set the site on the quadrant.
4. To set the range on the quadrant.
5. To center the cross level bubble of the quadrant.
6. To close the breech.
7. In indirect laying, to give the elevation.
8. To call **set.**
9. To fire the piece.
10. To measure the site when directed.

To Measure the Site.

143. The gun being accurately laid on the target by means of the panoramic sight, the sight-shank being set at any convenient range, 2700, for example, the instructor commands:

1. **Measure the site.**
2. **2700.**

1. At the command 2700, No. 1 sets 2700 on his range disk.
2. Centers the cross level bubble, if necessary.
3. Centers the bubble of the elevation level by turning the micrometer screw.
4. Call out the site reading, thus: **Site 330.**

No. 2.

144. The duties of No. 2 in the service of the piece are:

1. To shift the trail so as to give the general direction to the pieces.
2. To throw the empty cartridge cases out of the way of the gun squad.

3. Moves the muzzle to right or left at command: 1. **Muzzle,** 2. **RIGHT (LEFT).**

4. Shifts muzzle to the right (left) at such command as 1. **Right (Left) 50.**

No. 3.

145. The duties of No. 3 in the service of the piece are:

1. To set the corrector.
2. To set the range on the fuze setter.
3. To set the fuze when the hand fuze setter is used.

146. The corrector having once been set, changes in the setting are usually made at the command: **Up (Down) (So many).**

The command **up** means that the corrector reading is to be increased; **down** means that the corrector reading is to be diminished.

147. The hand fuze setter is used only when the bracket fuze setter is not available. No. 3 sets the scales in a manner similar to that described for the bracket fuze setter. He also sets the fuze, No. 5 holding the round.

148. Increasing the corrector reading shortens the time of burning of the fuze and hence raises the point of burst of the projectile; decreasing the corrector reading lengthens the time of burning of the fuze and hence lowers the point of burst of the projectile.

No. 4.

149. The duties of No. 4 in the service of the piece are:

1. In time fire to complete the setting of the fuze.
2. To insert the round in the breech.
3. In volley fire to call out the number of the round as **3200 one, 3200 two, last round.**

150. The signal that **time fire** is to be used is the command: **Corrector (So much).** The signal that **percussion fire** is to be used is the command: **Shell,** or **Percussion.**

151. When the hand fuze setter is used, and in percussion fire, No. 4 receives a round of ammunition directly from No. 5 and inserts it in the breech.

152. In percussion fire No. 4, after taking a round from No. 5, stands at his position at the breech and loads the piece **as soon as the previous round has been fired.** No. 4 is thus always ready to load the piece without loss of time. He takes care to stand clear of the breech during recoil.

No. 5.

153. The duties of No. 5 in the service of the piece are:
1. To take ammunition from the chest.
2. When the bracket fuze setter is being used, to insert the round in the fuze setter and to set the fuze, first removing waterproof cap.
3. When the hand fuze setter is used, to hold the round while No. 3 sets the fuze, first removing waterproof cap.
4. To pass the round directly to No. 4 in percussion fire, and when the hand fuze setter is used in time fire.

5. As soon as No. 4 removes a round from the fuze setter, No. 5 immediately places another shrapnel in the fuze setter and sets the fuze.

Nos. 6 and 7.

154. Nos. 6 and 7 have no specific duties in the service of the piece after it is established in position. They act as spare cannoneers.

155. Upon going into action, Nos. 6 and 7 are utilized for the construction of concealment for the carriages, for line guards on the telephone lines, for the resupply of ammunition, etc. This work is done under the immediate supervision of the executive or his assistant.

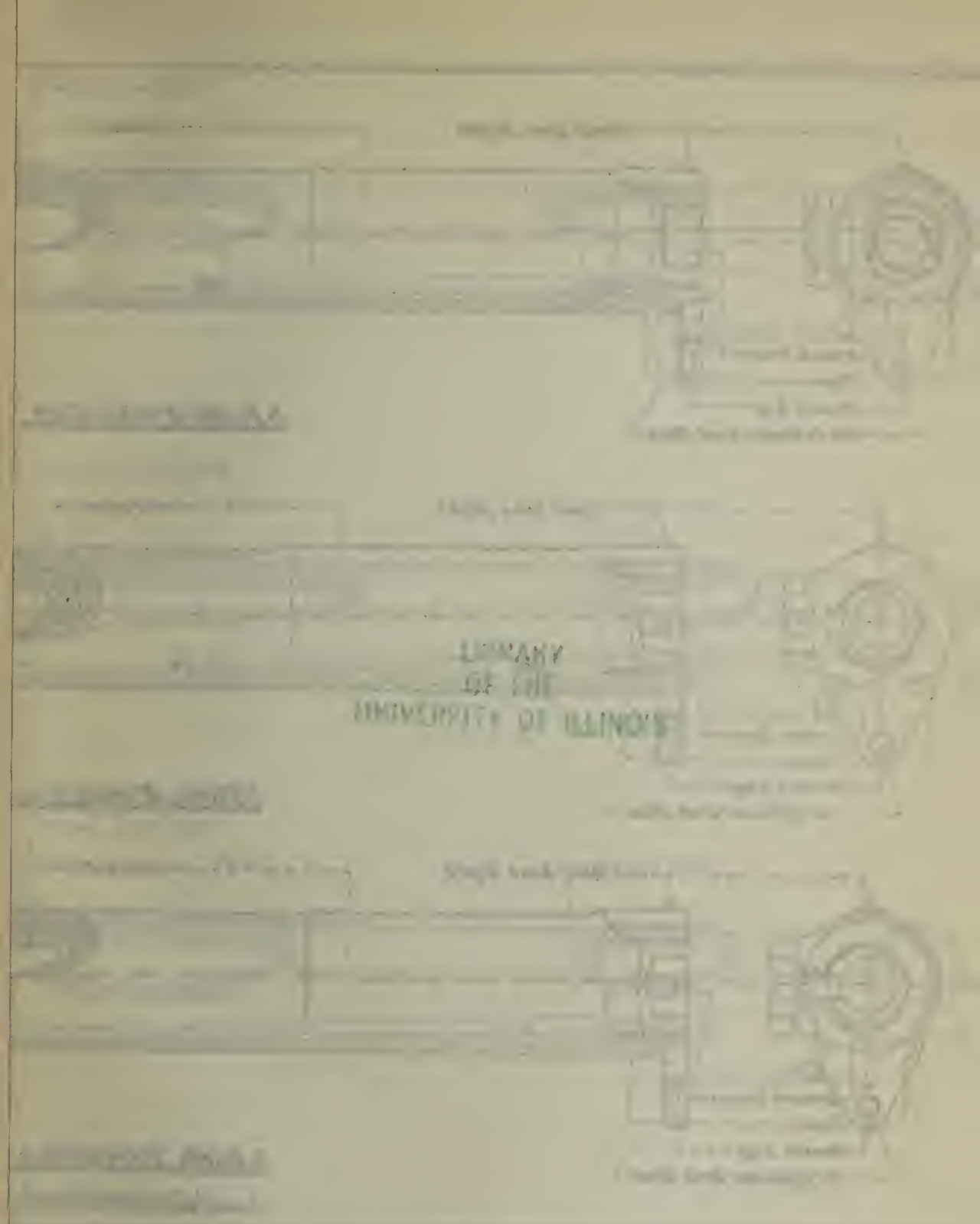
Combined Training at the Piece and at the Caisson.

156. The duties of the gunner and Nos. 1 and 2 are mutually dependent. So also are those of Nos. 3, 4, and 5.

The efficient service of the gun depends upon the orderly coöperation of the members of the gun squad, as well as upon the skill of the individual cannoneers. The habit of combined effort must hence be acquired.

157. Types of Commands.

Direct Laying	*Indirect Laying*
Target, that battery	Aiming point, that steeple
Deflection 5	Deflection 3670
Corrector 30	On 1st Piece Close 10
Battery Right	Site 310
2800	Corrector 28
	Right Right
	3600



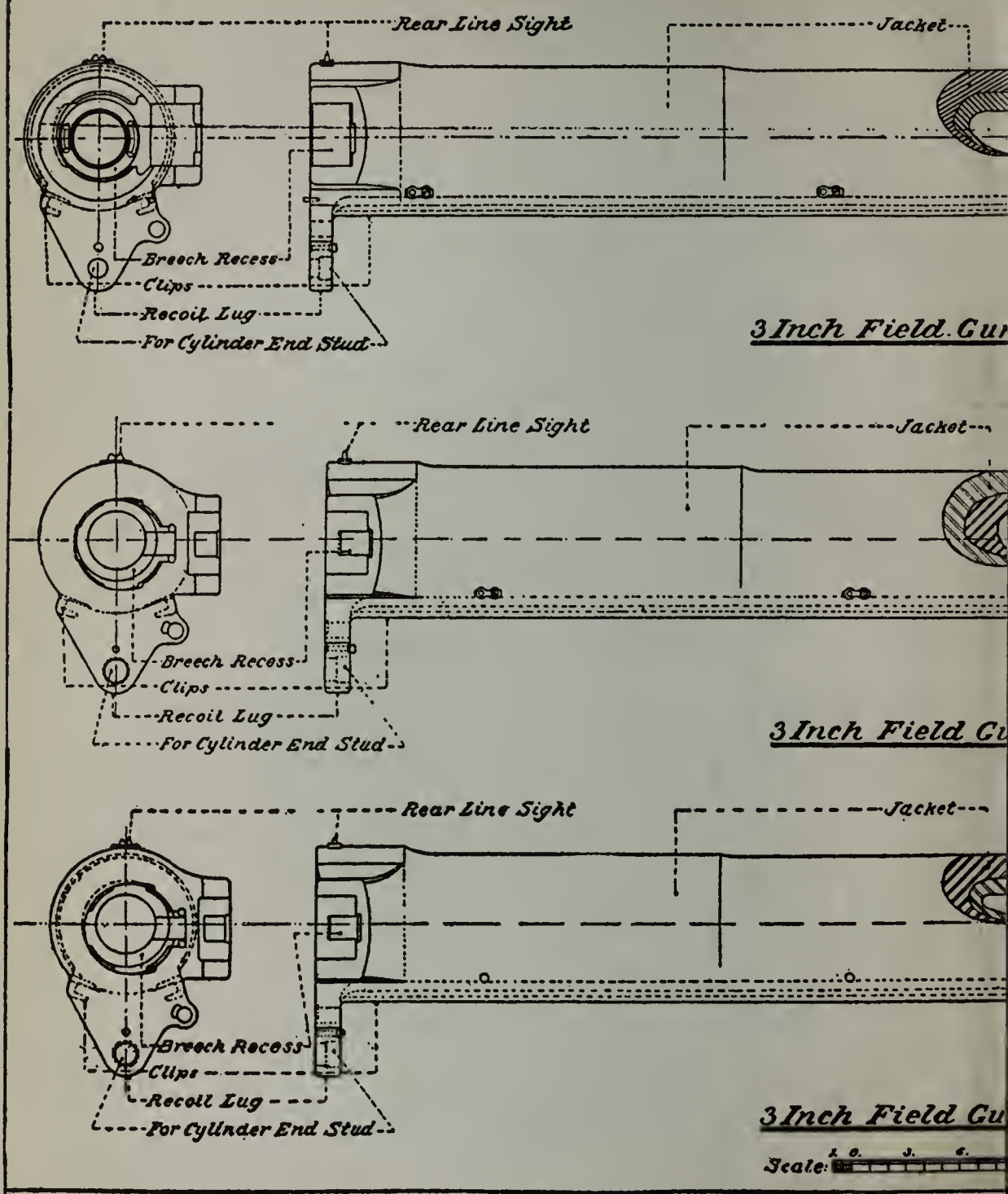
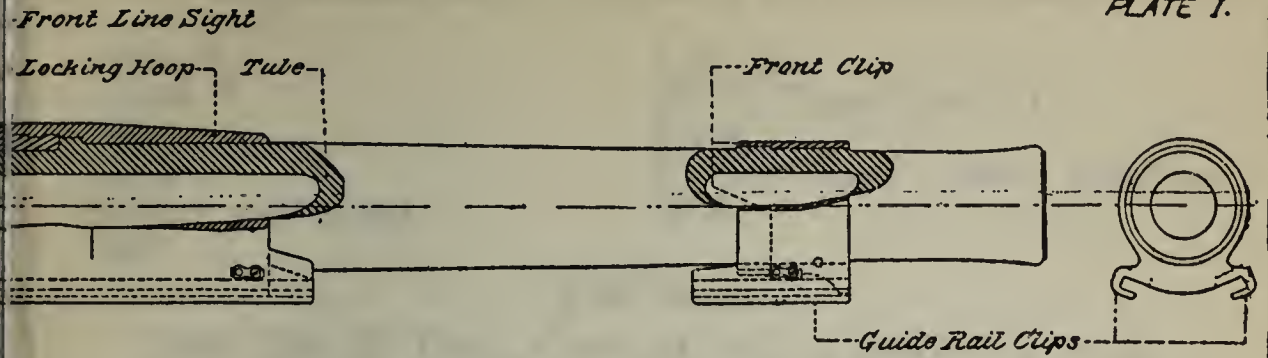
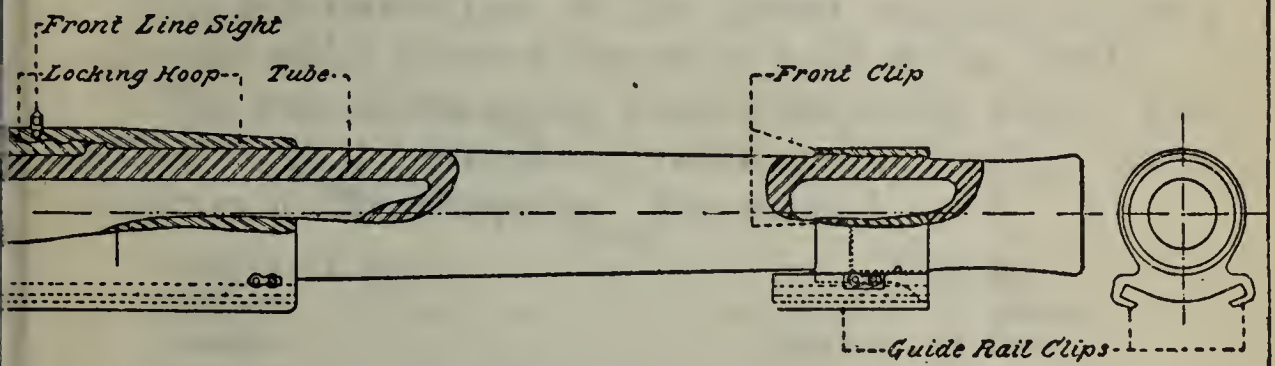

Rear Line Sight
Jacket
Breech Recess
Clips
Recoil Lug
For Cylinder End Stud
3 Inch Field Gun
Rear Line Sight
Jacket
Breech Recess
Clips
Recoil Lug
For Cylinder End Stud
3 Inch Field Gu
Rear Line Sight
Jacket
Breech Recess
Clips
Recoil Lug
For Cylinder End Stud
3 Inch Field Gu
Scale

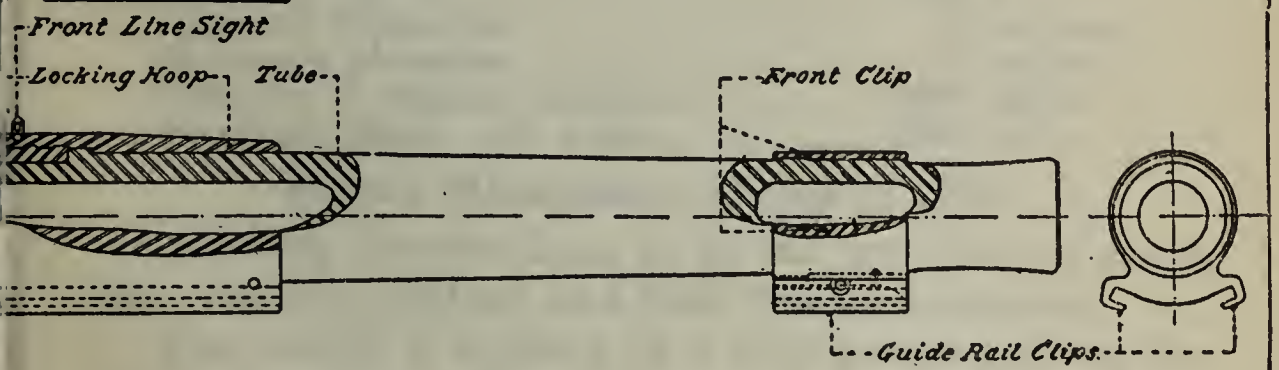
PLATE I.



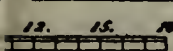
Model of 1902



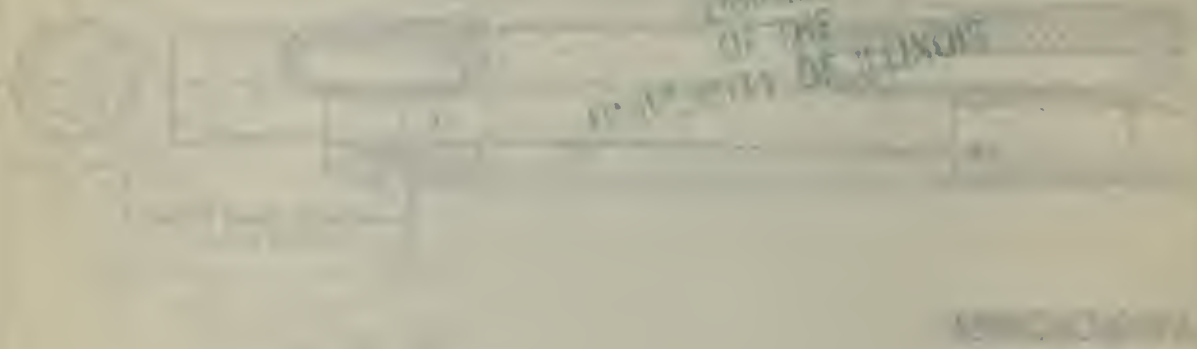
Model of 1904



Model of 1905



CLASS 36 | DIVISION 2 | DRAWING 5



Right 5
Down 3
2600
Up 2
Battery one round
2600

Left 50
On 3d Piece Open 10
Up 5
Battery three rounds, sweeping
3600

The Gun.

158. The 3″ Field Gun, Model of 1905, is a built-up construction of nickel steel and consists of a tube, jacket, locking hoop and front clip.

On the under part of the jacket and clip are two grooves which fit over the guide rails of the cradle.

The gun slides along these rails when fired. The rifling is of the increasing twist variety and gives the rotation to the projectile. See plate I.

Weight of gun	778	lbs.
Caliber	3	inches.
Length about	7	feet.
Number of lands and grooves	24	
Maximum pressure	33000	lbs. sq. in.
Muzzle velocity	1700	f. s.
Limit of depression	5	degrees.
Maximum elevation	15	degrees.
Range at 15 degrees elevation	6000	yards.
Maximum range, trail sunk	8500	yards.

Breech Mechanism, Model of 1905.

159. The breech-block is of the interrupted screw type, has four slotted and four threaded sectors.

The breech is opened by a continuous pull on the operating lever. The first part of the rotation of the lever unlocks the threaded sectors, the last part of the motion swinging the block to the rear and right.

The breech is closed by a reverse motion.

The breech-block is eccentrically mounted with reference to the axis of the bore, so that the vent comes opposite the primer only when the breech-block is fully closed.

160. The firing mechanism is of the continuous-pull type; the pull on the firing handle first cocking and then tripping the firing pin. See plate III.

The Gun Carriage.

161. The 3″ gun carriage is of the type known as the long recoil, the gun on the carriage recoiling about 45 inches, the carriage not moving after the first shot, which engages the trail spade.

The gun is mounted upon a cradle which houses the recoil controlling parts. The cradle rests upon a rocker and can be traversed upon it for 70 mils each way.

The rocker is strapped to the axle and its rear end is supported by the elevating screw. See plates IX and X.

162. The recoil controlling parts inside the cradle are the recoil cylinder, piston head, throttling bars, piston rod, counter recoil buffer, counter recoil springs, spring support.

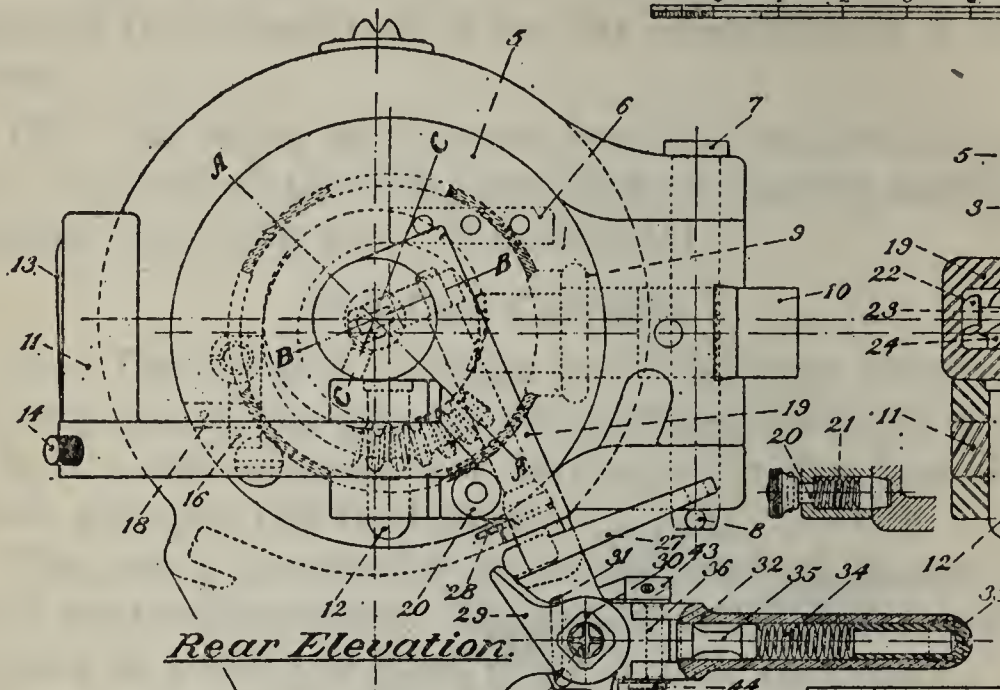
The inside of the recoil cylinder is filled with hydrolene oil. The oil freezes only at very low temperatures.

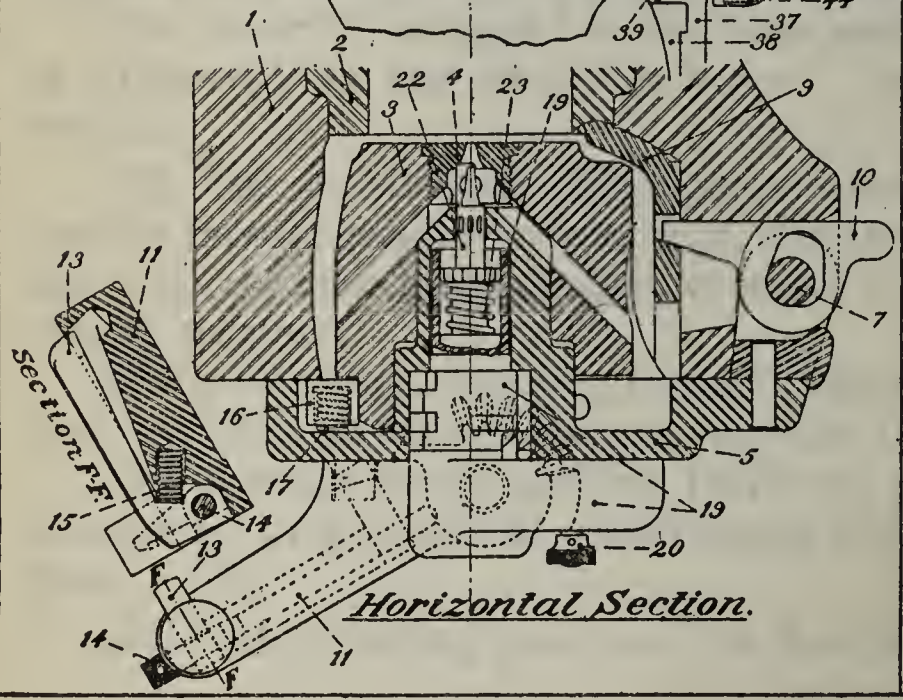
The counter recoil springs (three in number) are assembled with an initial compression of 500 lbs. See plate XIII.

163. The elevating gear is of the double-screw type,

3 Inch Field Gun, Models

Breech Mechanism A



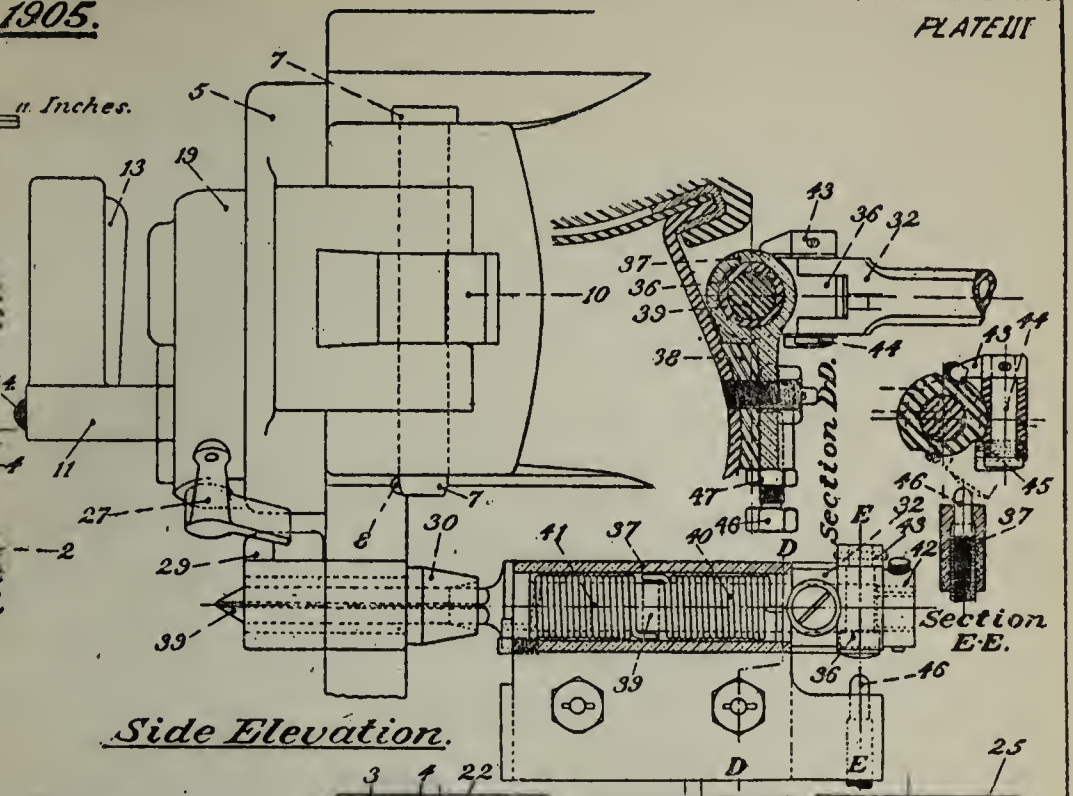


No.	Name of Part
1	Jacket
2	Tube
3	Breech Block
4	Vent Bushing
5	Block Carrier
6	Block Stop
7	Hinge Pin
8	Hinge Pin Catch
9	Extractor
10	Extractor Lever
11	Operating Lever
12	Lever Pivot
13	Lever Latch
14	Lever Latch Pivot
15	Lever Latch Spring
16	Block Latch
17	Block Latch Spring
18	Block Latch Pivot
19	Firing Lock Case
20	Locking Bolt Nut & P.
21	Locking Bolt Spring
22	Firing Pin
23	Firing Pin Spring
24	Firing Spring Sleeve
25	Sear

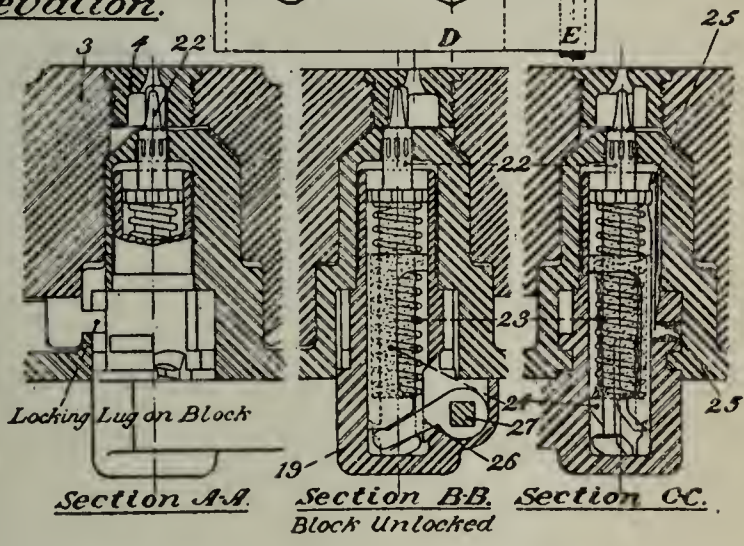
1904 & 1905.

embled.

Section.



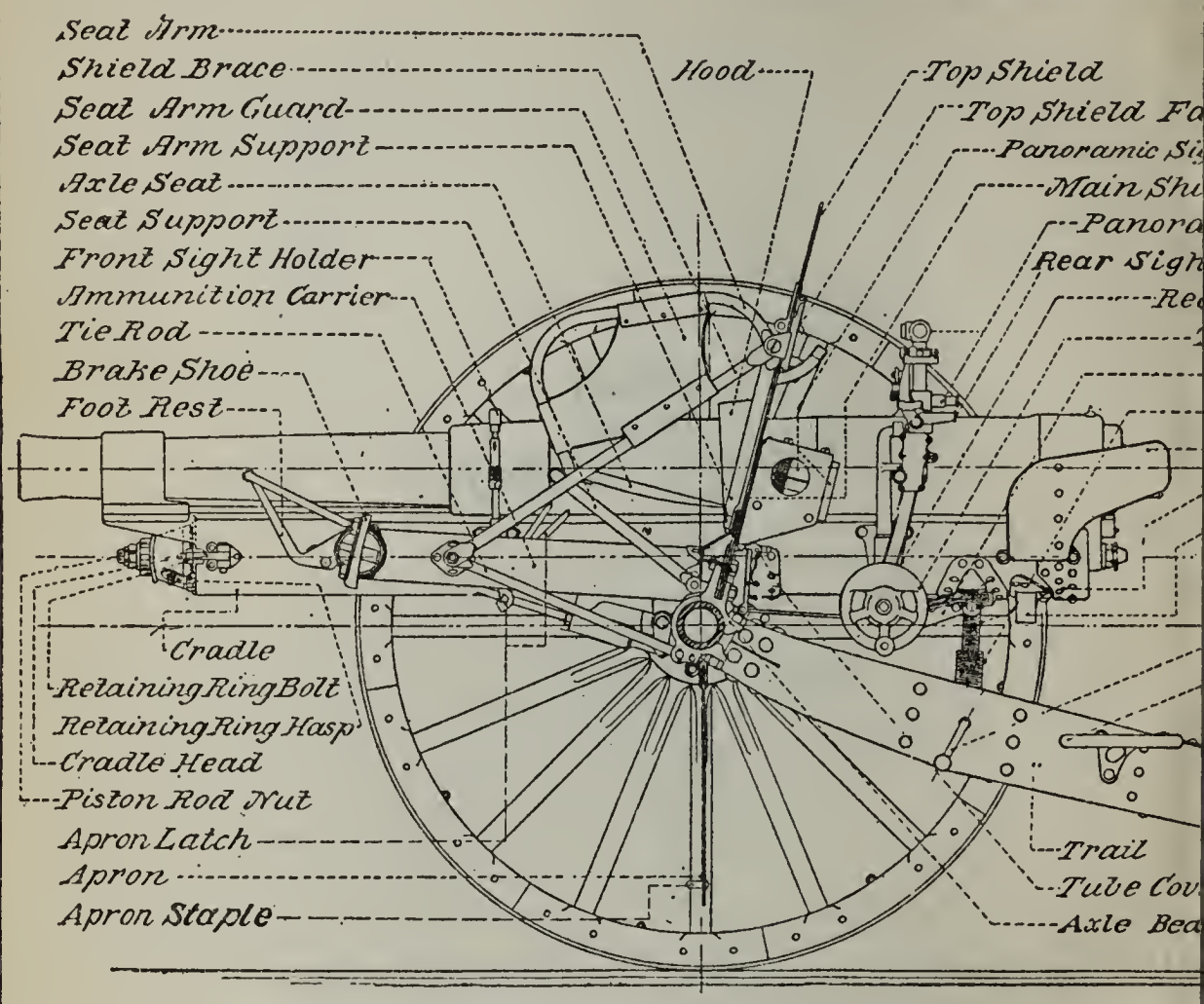
Side Elevation.



Section A.A. Section B.B. Section C.C.

No.	Name of Part
26	Trigger Fork
27	Trigger Shaft
28	Trigger Shaft Detent
29	Firing Pallet
30	Pallet Shank
31	Pallet Pin
32	Firing Handle
33	Firing Handle Plug
34	Firing Handle Spring
35	Firing Handle Plunger
36	Firing Handle Hub
37	Firing Handle Bracket
38	Bracket Seat
39	Firing Handle Shaft
40	Handle Return Spring
41	Shaft Return Spring
42	Tripping Collar
43	Trip Latch
44	Trip Latch Plunger
45	Trip Latch Spring
46	Adjusting Screw
47	Check Nut

3 Inch Gun Carria



Side Eleva

Scale 0 5 10 15 20

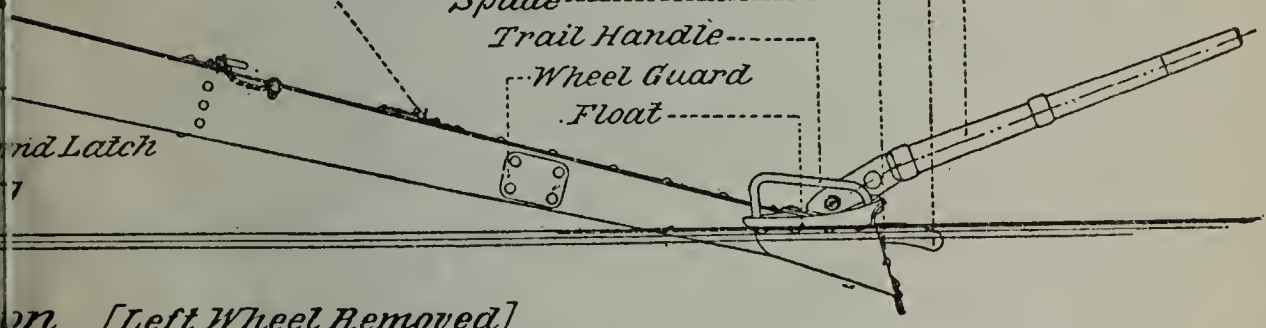
REVISED JUNE 4. 1908. FEB 6.1911

?, Model of 1902.

ning
Case

? Sight

Sight Bracket Support
versing Handwheel
Locker
-Elevating Screws (Inner and Outer)
---Shoulder Guard
--------Cradle
Lug For Traversing and Elevating Lock
----------Elevating Crank
----------Seat
---------Handspike Fastening
Handspike
Lunette
Spade
Trail Handle
Wheel Guard
Float
nd Latch
7

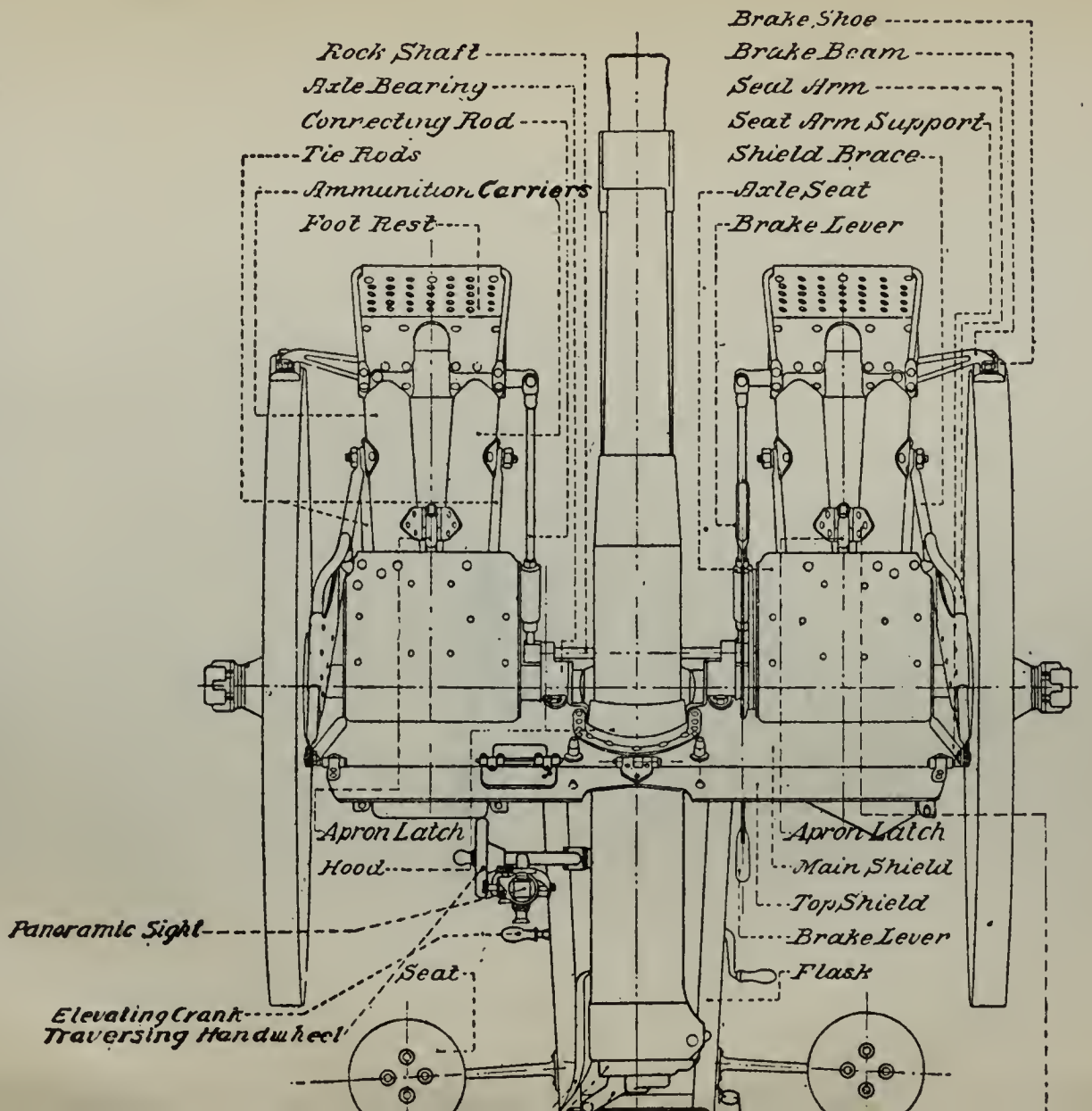


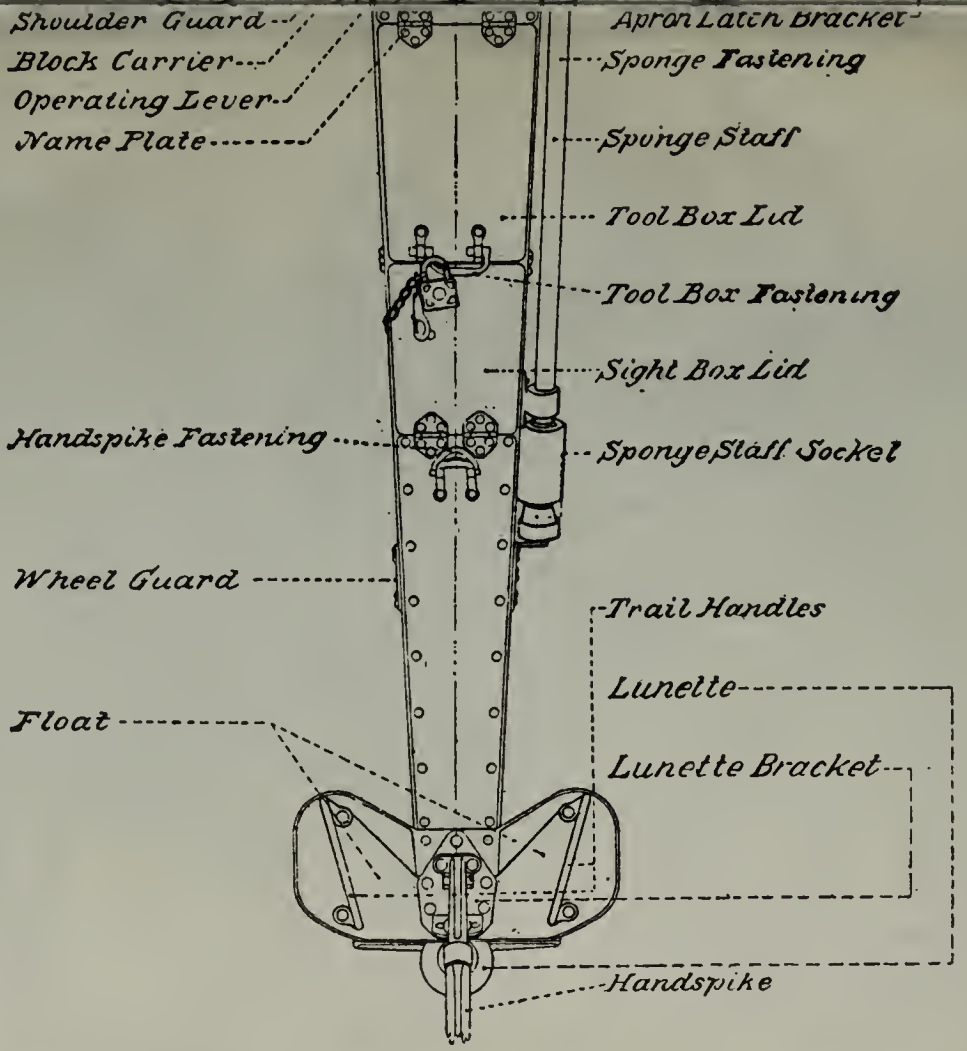
on [Left Wheel Removed]

30 35 40 45 50 55 60 65 70 Inches.

CLASS 36-DIVISION 2-DRAWING 4

PLATE X

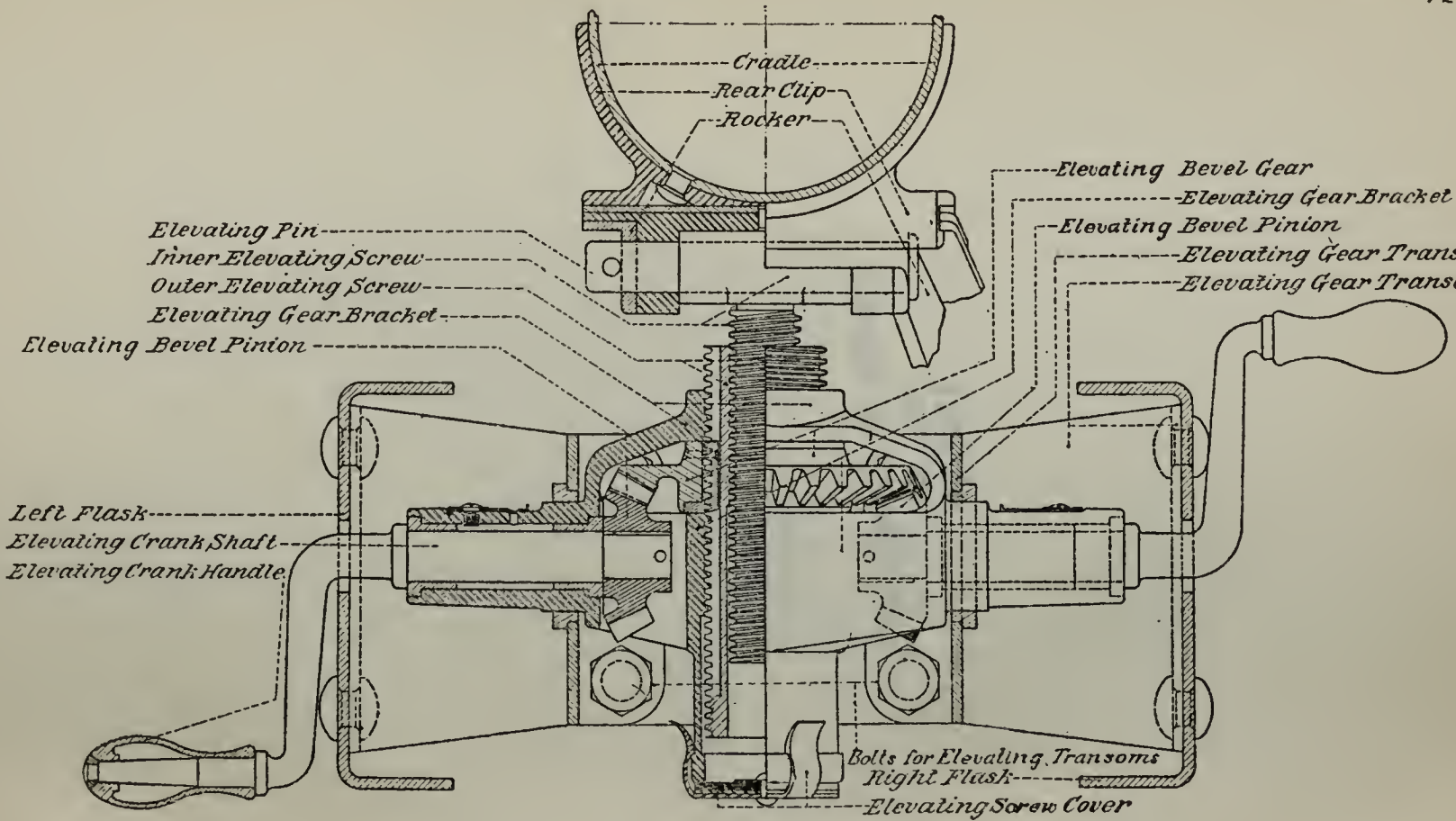

Brake Shoe
Brake Beam
Seal Arm
Seat Arm Support
Shield Brace
Axle Seat
Brake Lever
Rock Shaft
Axle Bearing
Connecting Rod
Tie Rods
Ammunition Carriers
Foot Rest
Apron Latch
Hood
Panoramic Sight
Seat
Elevating Crank
Traversing Handwheel
Apron Latch
Main Shield
Top Shield
Brake Lever
Flask



3 Inch Gun Carriage. Model of 1902.

Plan

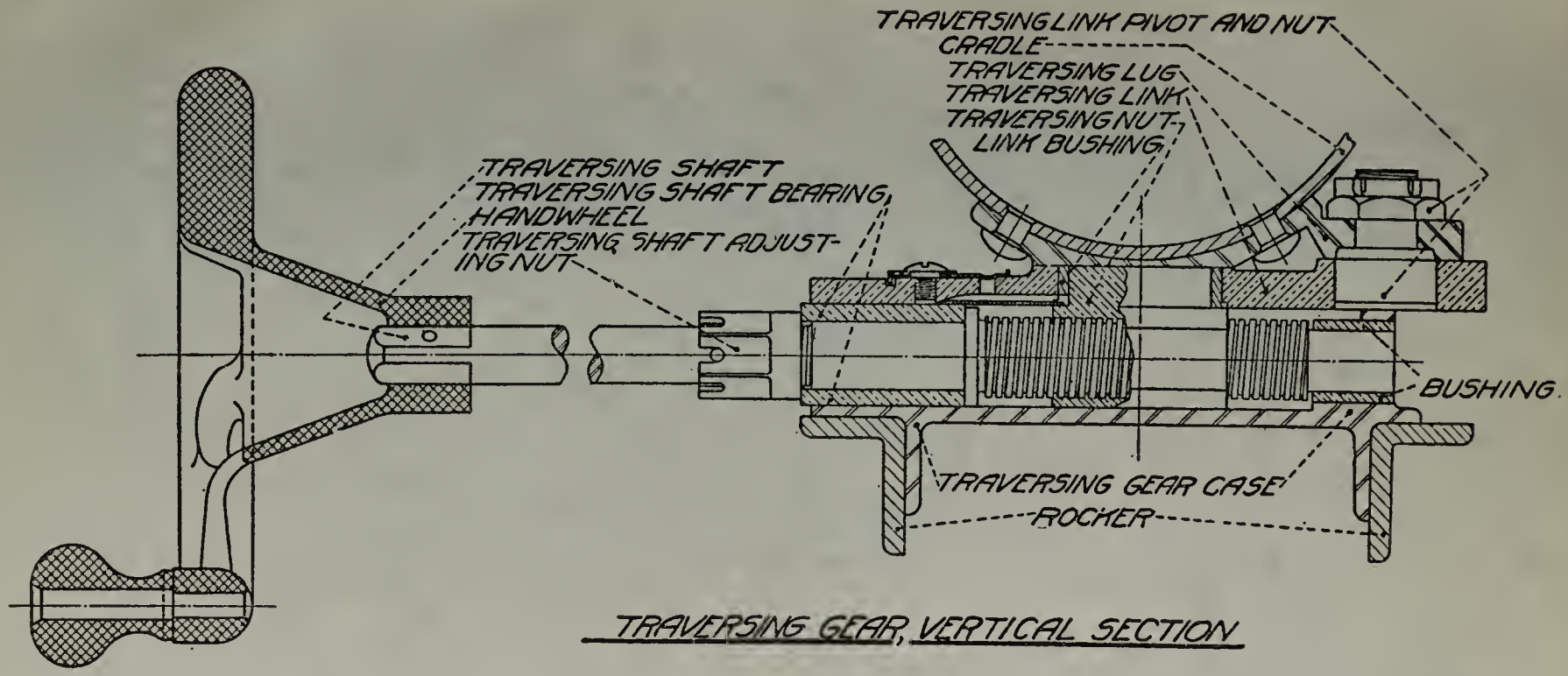
Scale 0 5 10 15 20 25 30 35 40 45 50 Inches



Elevating Gear Half Elevation and Half Section

Scale: 1 0 1 2 3 4 5 6 Inches

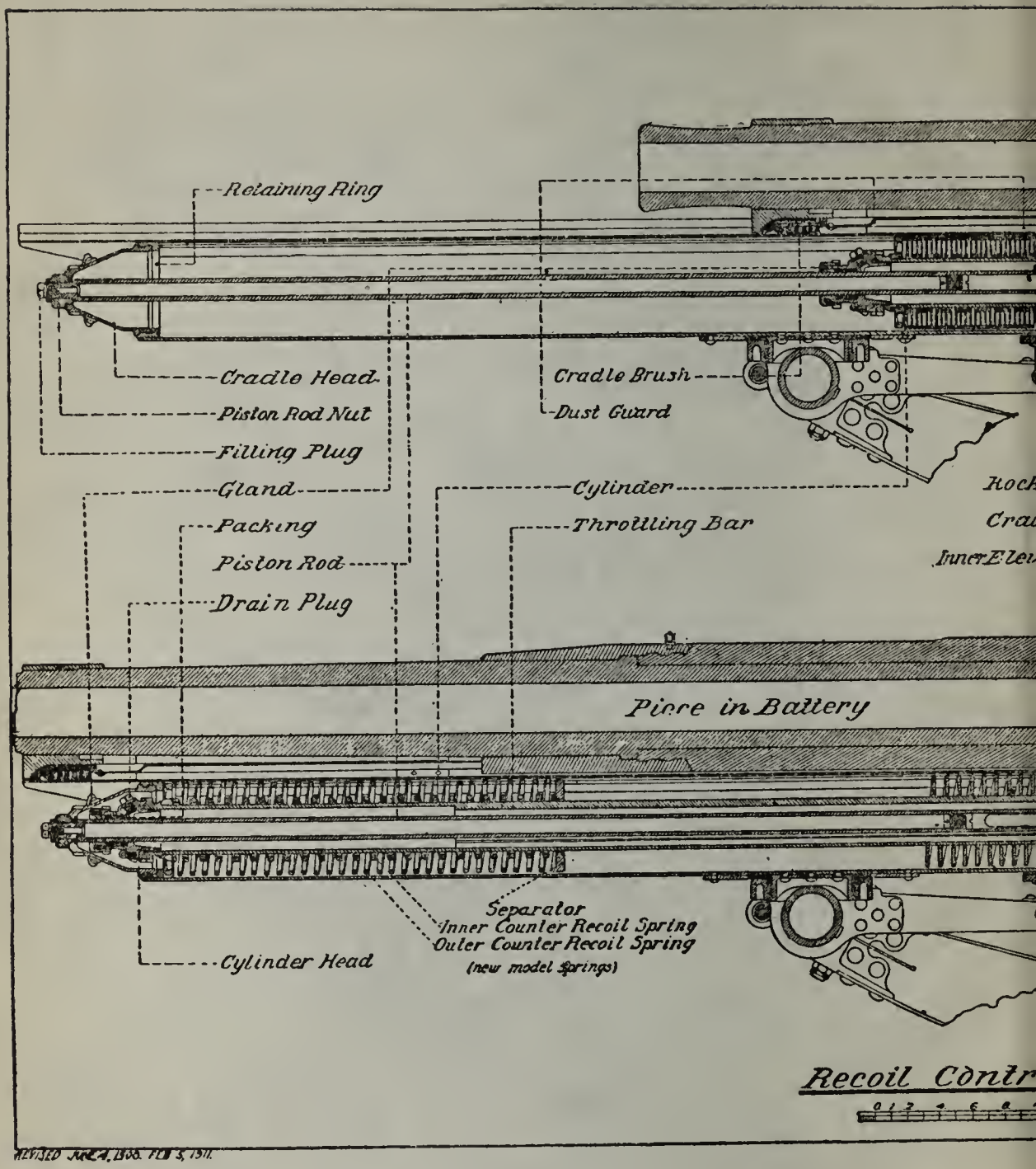
PLATE XII



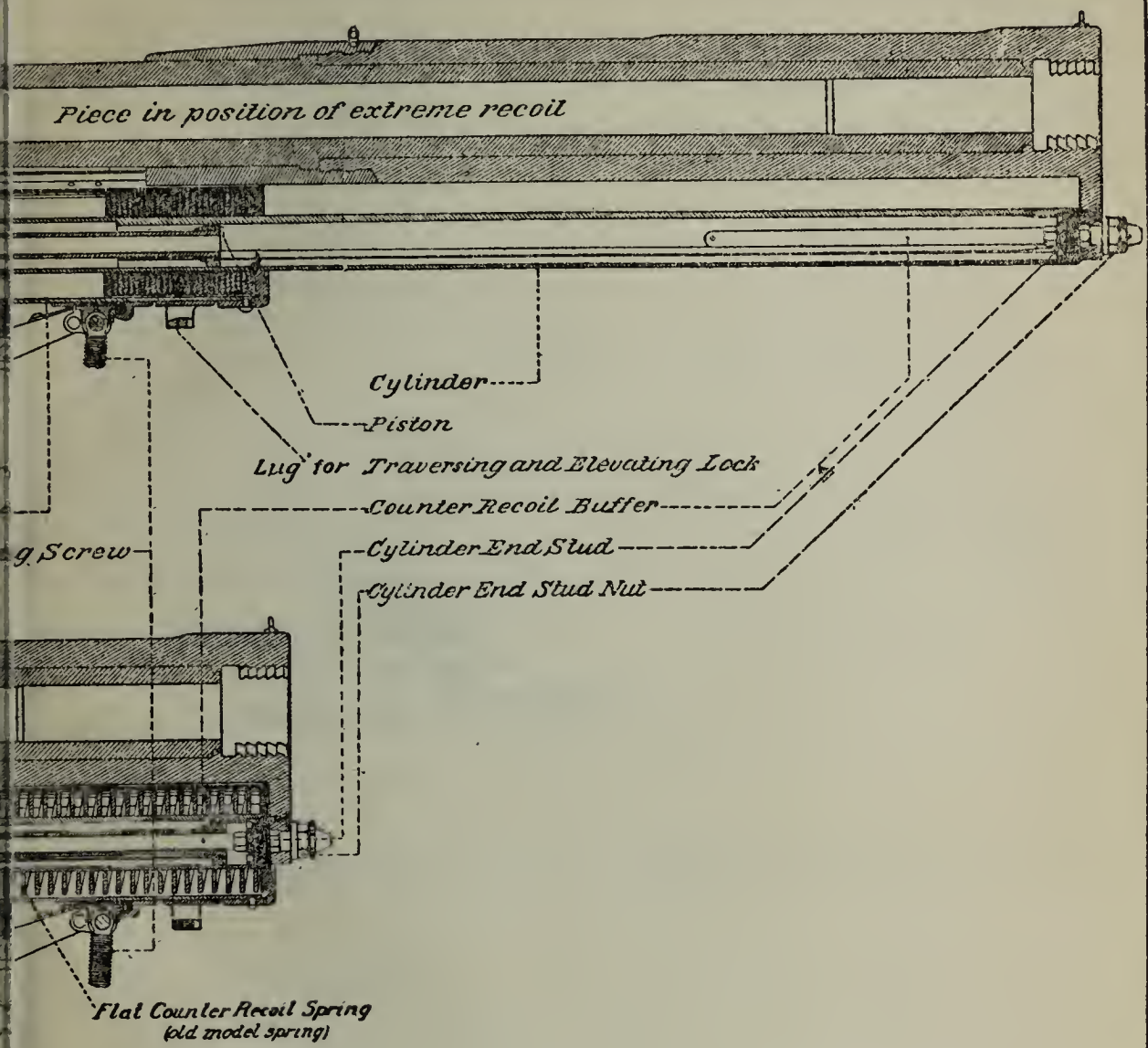
TRAVERSING GEAR, VERTICAL SECTION

SCALE 0 1 2 3 4 5 6 INCHES

CLASS-36 DIVISION-2 DRAWING-7

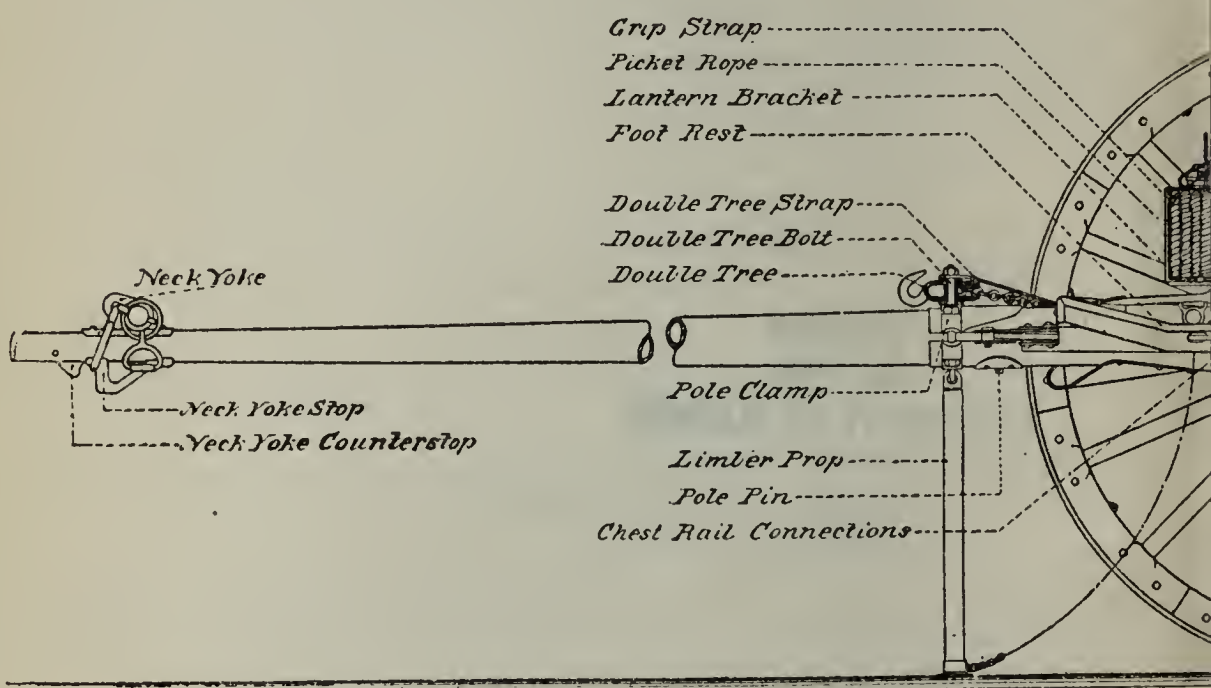


REVISED JUNE 4, 1908. FEB 3, 1911.



ing Mechanism

Inches.

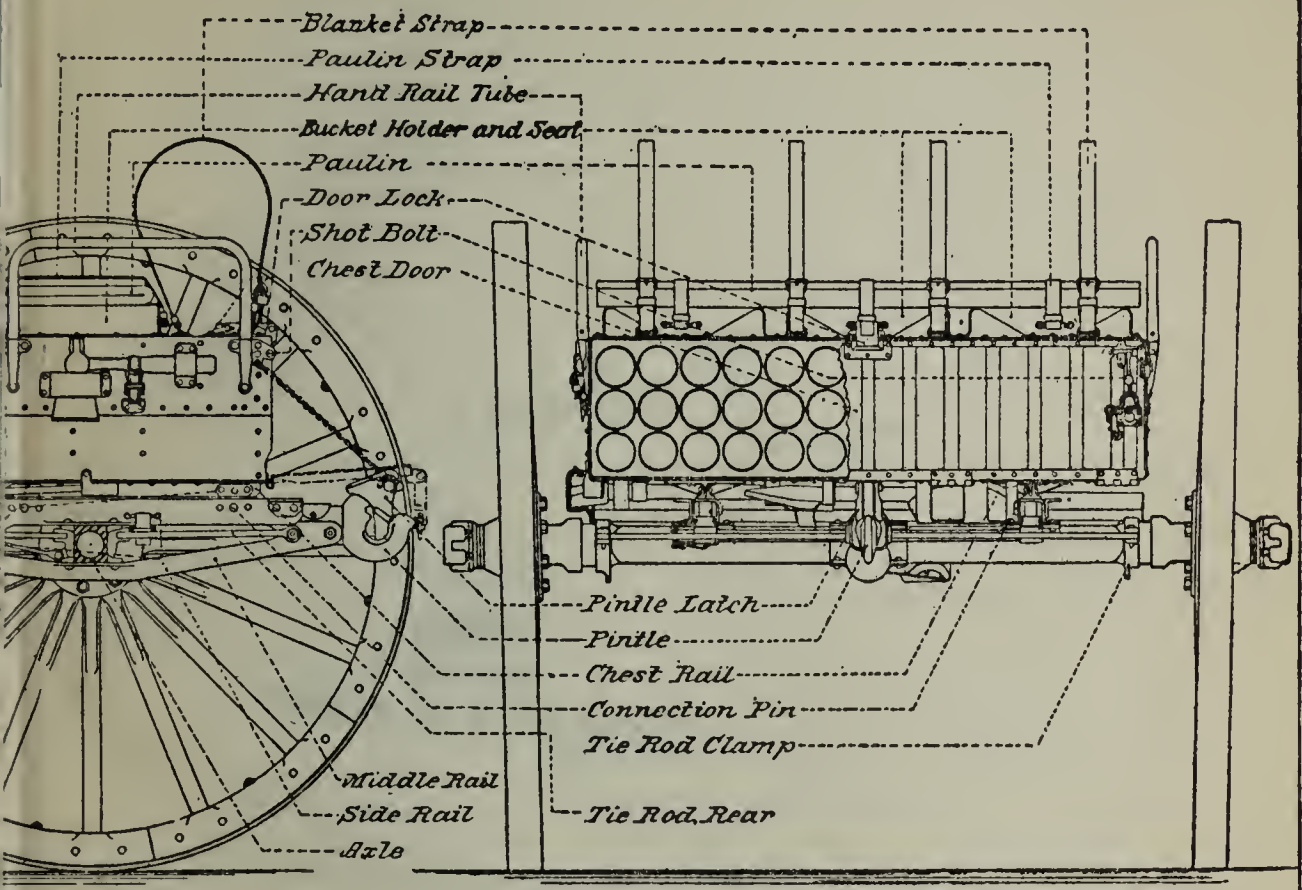


Lim

Scale: 1 0

REVISED JUNE 4, 1908. FEB 6. 1911

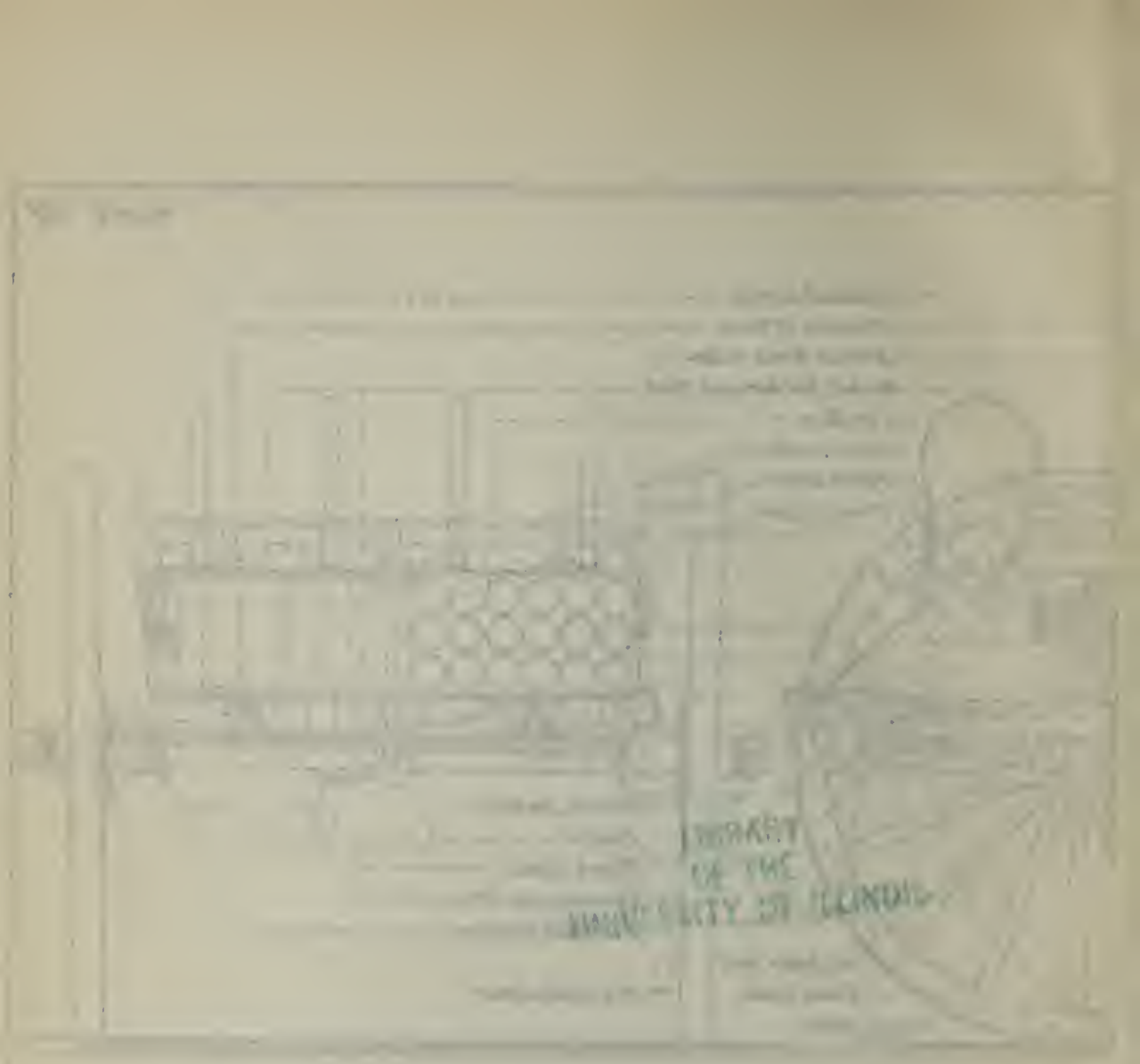
PLATE XIV

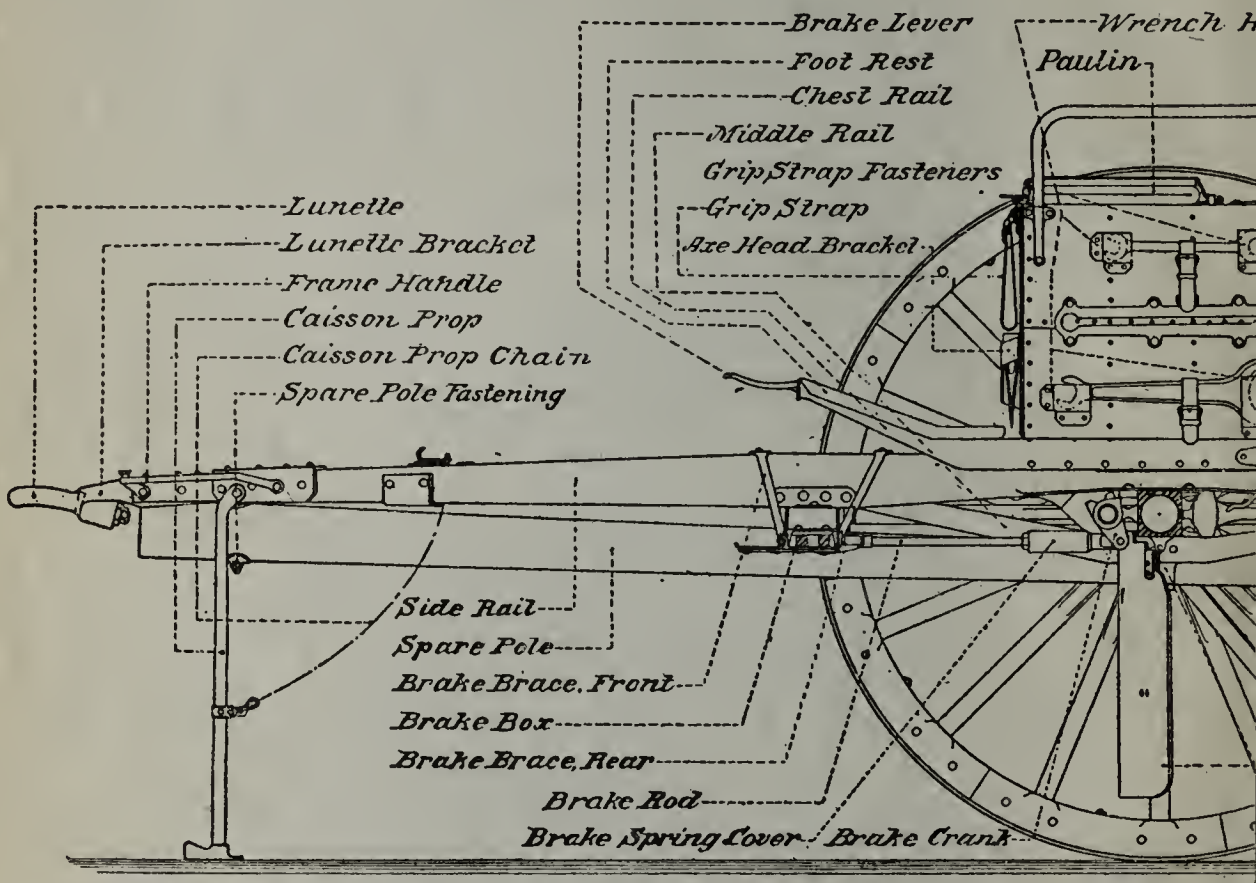


r, Side and Rear Views

0 20 30 40 50 Inches

CLASS J6-DIVISION 2-DRAWING 9

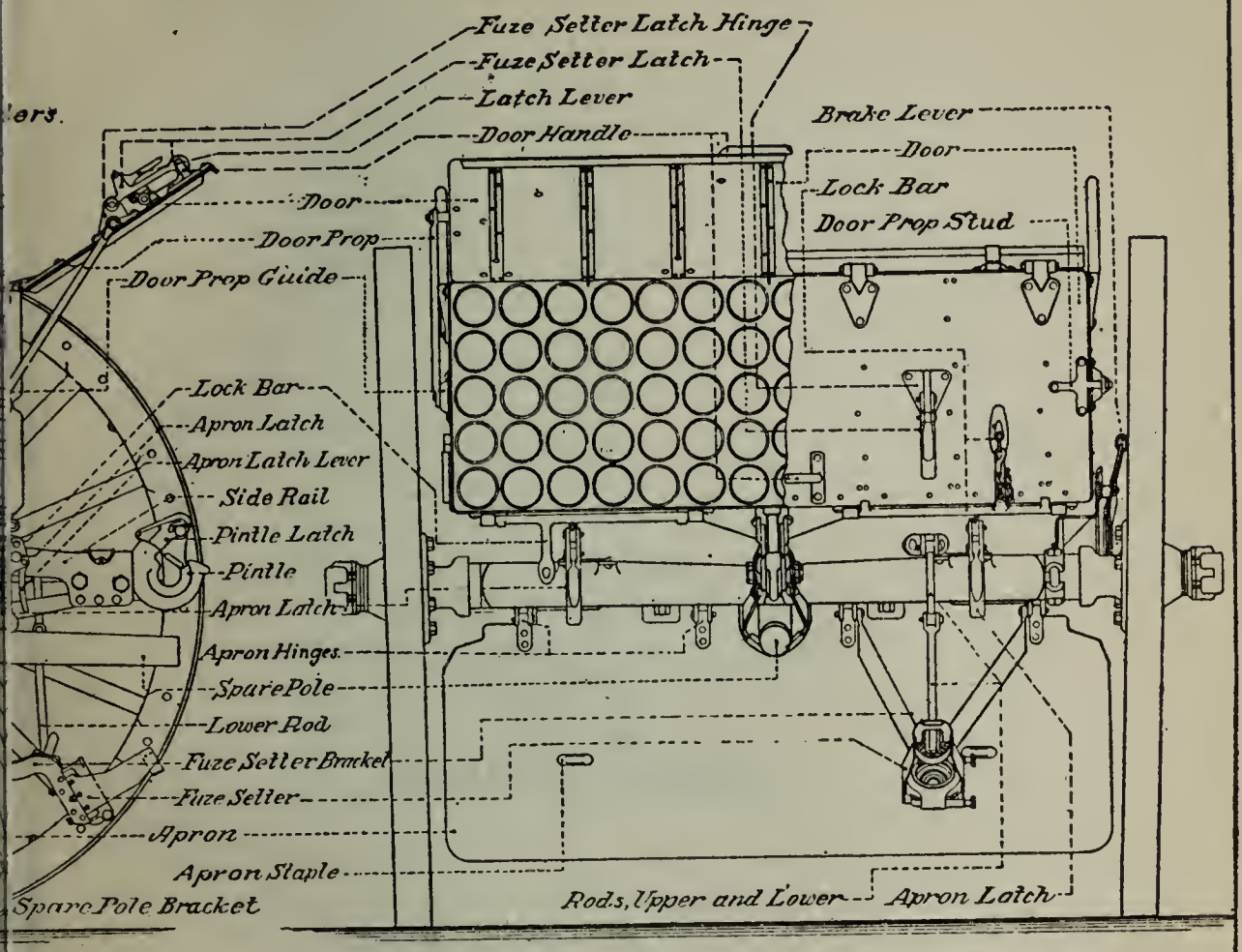




Caisson Side

Scale: 0 1 5 10 15 20

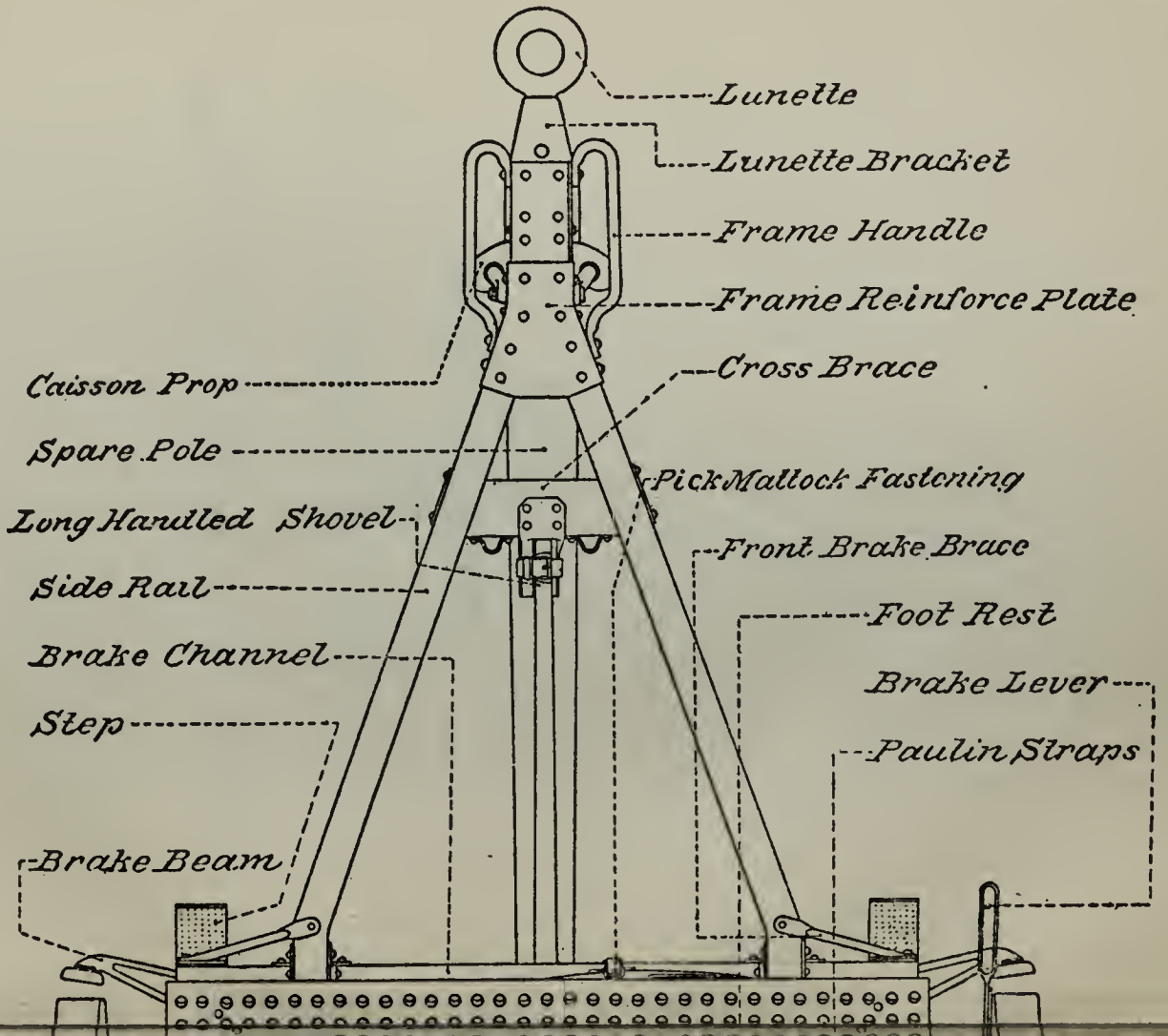
REVISED JUNE 4, 1908 FEB. 6, 1911

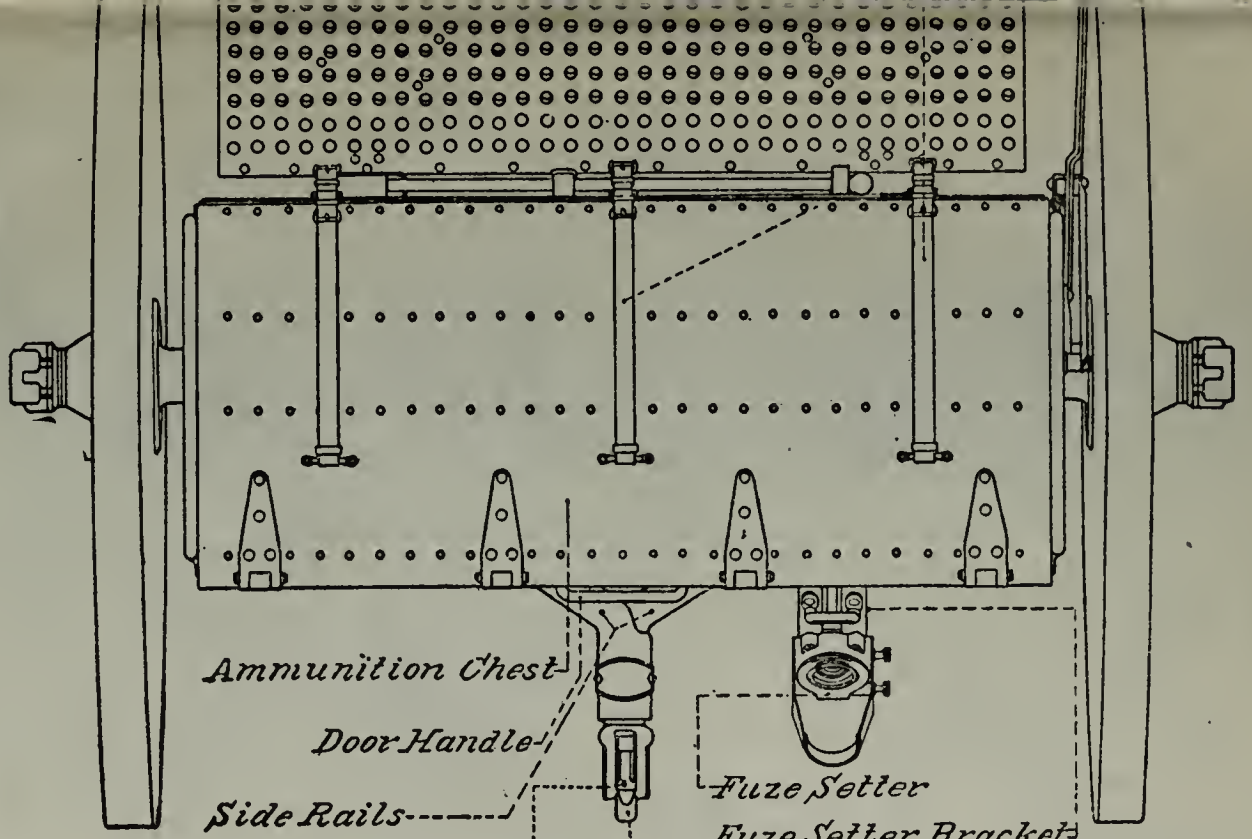


d Rear Views

30. 35 Inches

PLATE XVI


Lunette
Lunette Bracket
Frame Handle
Frame Reinforce Plate
Cross Brace
Caisson Prop
Spare Pole
Pick Mallock Fastening
Long Handled Shovel
Front Brake Brace
Side Rail
Foot Rest
Brake Channel
Brake Lever
Step
Paulin Straps
Brake Beam



Caisson, Plan

0 2 4 8 12 16 20 24 28 32 36 40 Inches.

REVISED JUNE 4, 1908. FEB. 6, 1911.

CLASS 36-DIVISION 2-DRAWING 11

thus getting twice as much elevation and speed as with one elevating screw of the same length and pitch of threads. See plate XI.

164. The traversing mechanism consists of a steel shaft threaded upon its central portion, and is mounted in the rocker. As the shaft is rotated the traversing nut moves back and forth along it. The cradle is attached to the traversing nut by the traversing link. See plate XII.

3-inch Gun (Caisson) Limber.

165. Weight of limber, equipped and loaded .....1740 lbs.
Weight of gun, carriage and limber, equipped and loaded .....4260 lbs.
Number of rounds carried..... 36
See plate XIV.

166. Weight of caisson, equipped and loaded .....2820 lbs.
Weight of caisson and limber, equipped and loaded.....4560 lbs.
Number of rounds carried in caisson only 70
See plates XV and XVI.

To Remove and Replace a Hub Liner.

167. **To remove a hub liner:** Remove the wheel from the axle and drive the liner out by striking with a heavy hammer or sledge upon the hub-liner driving tool (a bronze tool furnished for the purpose) placed against

the small end of the liner. Replace the hub liner in the reverse order.

To Dismount and Assemble the Elevating Screws.

168. To dismount the elevating screws: Remove the elevating pin; unscrew the inner screw by hand; remove the elevating-screw cover; remove the outer screw by screwing it down through the elevating-gear bracket. Assemble it in the reverse order.

To Remove and Replace a Wheel.

169. Raise the wheel to be removed from the ground, by a jack or some such device.

Lift the hub latch which releases the hub latch plunger from the hub cap, then unscrew the hub cap by turning it to the left. Press the wheel-fastening plunger until it is flush with the inner surface of the wheel fastening and raise the wheel fastening clear of the axle. Remove the wheel.

Oils for Artillery Matériel.

170. For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil (or engine oil No. 1), clock oil, sperm oil, coal oil, neat's-foot oil, and light slushing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages *and for no other purpose.*

The lubricating oil (or engine oil No. 1) will be

used exclusively in all oil holes of the matériel, and in lubricating such parts as wheels and axles, gun and cradle slides, pintle socket, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breech-blocks, threads of breech recess, etc.

Clock oil should be used on the spindle and all bearings of the battery commander's telescope, bearings of the panoramic sight, range quadrant, and fuze setters, and on the observation telescope, field artillery plotter, and worms of the rear sight. In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the engine oil No. 1, and may be used on the gears of sights, fuze setters, range quadrants, parts of revolvers, etc.; engine oil No. 1 may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster Department.

Neat's-foot oil is used for the care and preservation of all leather equipment.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for an appreciable

length of time. Its use as a lubricant for mobile artillery is forbidden.

Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricating oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a **thin, uniform coat,** since this is **ALL** that is necessary to give good protection.

Except in very cold weather it can be applied by using a paint brush as when painting; in cold weather it should be applied by stippling—that is, lightly tapping the surface with the end of the sash tool held with bristles perpendicular to the surface to be covered. It can be applied to the bores of guns by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of guns.

It may be readily removed by the use of burlap or waste dipped in coal oil.

Care and Cleaning of Recoil Cylinders and Other Parts of Carriage.

171. The carriage must be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the methods of mounting and dismounting the various parts, and should *see* that the carriage is properly handled, cleaned, and cared for. The following general directions for its care and cleaning are given:

The recoil cylinder should be emptied and refilled once every three months, and thoroughly cleaned once every six months, or oftener if the conditions require it. The cylinder is most readily emptied and filled when removed from the carriage. For cleaning it is dismounted and the cylinder head, counter recoil buffer, and piston rod removed, as heretofore described. The interior of the cylinder, the piston, the counter recoil buffer, and the stuffing box should then be thoroughly cleaned by the use of cotton waste and coal oil and wiped dry with cotton waste. The removal of the packing is not necessary in cleaning. The cylinder bore should be carefully inspected, and if any rust has formed it should be removed with coal oil, using, if necessary, *fine* emery cloth. The latter must be used with great care to prevent any increase in the clearance between the cylinder and piston. If rubbing, burring, or scoring of the parts is noted, the rough spots should be carefully smoothed down by a skilled workman with a dead-smooth file or with emery cloth, and the cause of the roughness ascertained and removed. Where unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department charged with the duty of keeping the battery in repair for his information and action.

The parts should be reassembled immediately after cleaning and inspection, and the cylinder filled with the hydroline oil issued for that purpose. The piston should be moved back and forth in the cylinder by

hand to make sure that all parts are correctly assembled and are without interference. The cylinder should then be mounted in the carriage and the gun pulled from battery by hand and permitted to counter recoil rapidly to insure that all parts are in proper position for firing. *This should never be done, however, unless the cylinder is known to be filled with oil.* In reassembling the parts the condition of the vulcanized-fiber washers between cylinder heads and cylinder, and cylinder-end stud and cylinder end should be noted; they should be replaced whenever necessary to prevent leakage. In removing and inserting the piston rod care should be taken to keep it central in the cylinder, so as not to bind, burr, or spring any parts. The dismounting and reassembling of the parts of the cylinder should in every case be supervised by a commissioned officer. Before firing an inspection should be made to ascertain that the different parts, especially the piston rod and cylinder-end stud nuts, are correctly assembled.

The recoil-cylinder oil should be stored in the closed cans provided for the purpose, and be carefully protected from dirt, sand, or water. Oil withdrawn from cylinders and containing any sediment must not be used again until it has been allowed to settle for not less than 24 hours. When sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the oil. To insure the cleanliness of all cylinder oil it should be strained through a clean piece of linen or muslin before using.

The exterior of the cylinder should be kept well oiled and free from rust or dirt, and an inspection made at least once each month to ascertain its condition. Where rust has formed it should be removed with coal oil, and, if necessary, emery cloth. For shipment or storage, or where the carriage is to stand without firing for extended periods, the cylinder should be coated with the light slushing oil used for the bores of the guns.

The counter-recoil springs should be dismounted at least once every six months and be thoroughly cleaned. All rust should be removed and the springs well oiled before reassembling. When the springs are dismounted the interior of the cradle should be cleaned and examined for defective riveting, missing rivet heads, and scoring. The condition of the spring-support guides should be noted and all burrs or scores carefully smoothed off.

The recoil guide rails of the cradle should be kept well lubricated. Immediately before beginning to fire, they should be oiled through all the oil holes of the gun and dust guard. Lack of proper lubrication of these guide rails is the most frequent cause of the failure of the gun to return fully into battery.

The contact surfaces between cradle and rocker should be kept clean, thoroughly oiled, and free from rust. If indications of rusting, cutting, or scoring of these surfaces appear, the cradle should be dismounted, the rust removed, and the rough spots smoothed away.

The elevating and traversing mechanisms should be dismounted at least once every six months for thorough cleaning and overhauling. They should be kept well oiled and should work easily. If at any time either mechanism works harder than usual, it should be immediately overhauled and the cause discovered and removed.

In traveling, the cradle should be locked to the trail by means of the elevating and traversing lock, so as to relieve the pointing mechanisms of all travel stresses.

The wheels and wheel fastenings should be dismounted periodically and the fastenings, hub boxes, axle arms, and axle bore cleaned and examined. All roughness due to scoring or cutting should be smoothed off.

The hollow part of the axle acts as a reservoir for the oil to lubricate the wheel bearings. Experience will show how much oil is needed, but enough should be used to insure that the oil will pass through the axle arms to the hub caps.

The nuts on the hub bolts should be tightened monthly during the first year of service and twice a year thereafter. The ends of the bolts should be lightly riveted over to prevent the nut from unscrewing. When the hub bolts are tightened, the hub band should be screwed as tightly as possible against the lock washer at the outer end of the hub ring.

The importance of strict compliance with these

instructions cannot be overestimated. The wooden parts of the wheels are made of thoroughly-seasoned materials, and the hub bolts and bands, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if the wheel is used in this condition it will rapidly be made unserviceable and may be damaged beyond repair.

172. **To fill the cylinder:** *Practically all damages to the rear cradle head and parts of cylinder can be traced to the fact that the cylinder was not completely filled with oil. For that reason the cylinder should be filled with the greatest care; a commissioned officer should himself verify that the cylinder is full and that no air is left in it.*

The easiest way to fill a cylinder is when it is disassembled from the carriage. If assembled to the carriage, bring the gun to its maximum elevation and remove both filling and drain plugs. It is necessary that the drain-plug hole should be located on top of the cylinder. Fill through either hole. Allow a few minutes for the air to escape and the oil to settle. Refill and repeat two or three times. When satisfied that the cylinder is entirely full of oil, insert both plugs, and depress the gun to its maximum depression. After a few minutes elevate again to maximum elevation and unscrew both plugs. Now refill as described above. When entirely full allow not more than 2 cubic inches (about one-fourth gill) of the oil to escape; insert both plugs and lash them with copper wire.

It may happen that after firing a few rounds the

gun will not return to battery. This may be due to, first, weakness of springs; second, stuffing-box gland being screwed up too tightly; or third, the oil having expanded, due to heat.

In either case the cause must be ascertained and remedied; if due to expansion of oil it is proven by the fact that the gun cannot be pushed into battery by force exerted on the breech of the gun. In that case elevate the gun to its maximum elevation and remove the filling plug. The oil will now escape, permitting the gun to return to battery.

About 9 pints of oil are required for filling the recoil cylinder. Hydroline oil of a specific gravity of 0.85 is furnished by the Ordnance Department for use in these cylinders; it is characterized by its low freezing point and by its noncorrosive action on metals. The oil used in the cylinder should be clean and free from grit and dirt; to insure this it should be strained through a clean piece of linen or muslin before using. In emergencies water may be used in the cylinder. This should be done only when absolutely necessary, and never in freezing weather, and as soon as practicable the cylinder should be emptied, cleaned, and thoroughly dried and filled with hydroline oil.

173. **To dismount the springs:** Bring the gun to approximately zero degrees elevation; unscrew the cylinder-end stud nut and the piston-rod nut; shove the gun about 5 inches from "in battery"; attach the spring compressor to the cylinder-end stud and put

sufficient strain on the compressor to relieve the retaining ring from spring pressure; then remove retaining ring (and cradle head) by loosening and swinging aside the retaining-ring bolts; ease off on spring compressor until the springs are free.

174. **To assemble springs:** Place two of the springs in the cradle, the third one on the cylinder against the spring support; attach the spring compressor to the cylinder and pass the free end of the compressor from front to rear through the two springs in the cradle. Enter the rear end of the cylinder in the spring at the front end of the cradle; put sufficient strain upon the compressor to bring the spring column down to its assembled height. As the spring column approaches its assembled height the spring support must be turned so that its guide lugs properly enter in the spring-support guide grooves in the cradle; the rear end of the cylinder must then be centered so as to enter the hole in the rear end of the cradle; assemble the retaining ring. When the retaining ring is assembled the nuts for the retaining bolts should be screwed up until they just come into contact with the retaining ring. If these nuts are screwed up too tight they will deform the retaining ring, with the result that it becomes difficult to assemble and dismount the cradle head. The gun, if mounted, should be shoved about 5 inches from battery preliminary to this maneuver.

A wrench is provided for turning the spring support to its proper position.

175. The cylinder-end stud should never be removed when the gun is at an elevation, and the gun should not be elevated when the cylinder-end stud nut is not in place. To prevent the cylinder-end stud from rotating, a small screw called the "screw for cylinder end" holds it in place. *This screw for cylinder end must be removed before attempting to unscrew the cylinder-end stud.*

176. The springs are assembled under an initial load of over 500 pounds; a pull of more than 500 pounds must therefore be exerted upon the spring compressor in assembling them. This can readily be done by passing a handspike through a loop at the rear end of the compressor and making use of the services of the entire gun crew.

Steel Collars.

177. Steel collars are made in the following sizes:— 2A, 2B, 4A, 4B, 5, 5A, 5B, 6, 6A, 6B, 7, 7A, 7B, and 8A. The A and B shapes have straighter sides than the 5, 6, or 7.

There are seven sizes of pad connections and seven sizes of pads, increasing in width from No. 0 to No. 6.

178. The horses assignd to a single driver are called a **pair**; the horse on the left side is called the **near horse**; the other the **off horse.** The driver rides the near horse

The pairs assigned to the traction of a single carriage are termed collectively a **team.** A team usually consists of not less than three pairs. The leading pair

is called the **lead pair**; the one attached to the carriage the **wheel pair**; the pair between these two the **swing pair.** When there are two pairs between the lead and wheel pairs, the pair next behind the lead pair is called the **lead swing**; the other the **wheel swing** pair. When there are five pairs the one between the lead swing and the wheel swing is called the **middle swing pair.**

Disposition of the Harness.

179. In garrison.—The harness is arranged on two pegs on the heel posts, as follows:

On the upper peg: Both bridles hung from the peg by their headstalls; the traces of both horses hung over the peg close to the heel post; the off saddle with its attachments over the seat; the blanket across the saddle; both collars, unlocked, over the blanket. Pommel of saddle is placed next to heel post.

On the lower peg: The near saddle and blanket arranged as prescribed for the off harness.

The neck yoke, with martingales attached, is hung from a spike driven into the side of the heel post.

To prevent injury to the off saddle when the blankets are out drying, the sack is put over the harness and the collars are then placed across the sack.

180. In the field.—The pole prop is placed under the end of the pole. The wheel traces are detached from the collars only and laid back on the footboards. The remainder of the harness of the near-wheel horse is placed on the pole next to the doubletree, arranged as follows: The saddle with its attachments over it, the

blanket across the saddle, the bridle and collar over the blanket. The remainder of the off-wheel harness is placed next, then the swing, and lead harness in the same order. The traces of the swing and lead harness, folded once, are placed across the saddle. The neck yoke is placed on the footboard.

181. To avoid striking, frightening, or spoiling the horses the men are impressed with the necessity of working about them gently and quietly and of handling the harness carefully.

To Harness.

182. The harness being on the heel posts, the instructor causes the men to **stand to heel**; and commands: 1. **By detail,** 2. **HARNESS.**

Collar.—At this command each driver puts on and locks the collar of his off horse, then that of his near horse. To avoid pinching and clamping a portion of the skin or the mane between the collar and the collar pad, the collar is placed well up on the neck, locked, and then lifted gently to its position against the shoulders. By stooping down and looking at it, the driver should satisfy himself that the buckle latch is securely locked.

Saddle.—He puts on the blanket of the off horse, then the saddle with its attachments, taking care not to displace the blanket; buckles the collar strap to the saddle; turns back the back strap and, in the case of wheel drivers, the breeching, fastens the crupper and completes the saddling. He then saddles the near horse in like manner.

Traces.—He lays the middle of the traces of the off horse over the horse's back, behind the saddle, toggles on opposite sides, and, beginning with the off trace, passes the toggles through the trace loops from the rear and attaches them to the hame tugs on the collar. The traces of the near horse are then attached in the same manner. The rear ends of the traces are left hanging over the backs of the horses.

When the horses are harnessed for drill by pair, the traces, at the direction of the instructor, are either not attached or are **toggled up** by passing each trace over the back behind the saddle and slipping the ring of the trace chain over the toggle which attaches the opposite trace to the hame tug.

Bridle.—He bridles first the off horse, passing the reins through the roller, and then the near horse.

Unless otherwise instructed, the halters are removed before bridling.

Couple.—He turns his pair about so as to face the stable driveway and attaches the hook at the end of the coupling rein to the right pommel ring of the near saddle. He then stands to horse.

Yoke.—The wheel driver takes down the neck yoke; places himself between his horses, facing in the same direction with them; fastens the breast strap of the off horse, then that of the near horse; passes the martingale of the near horse between the forelegs, through the standing loop on the cincha; attaches the hooks at the end of the side straps to the martingale D ring; secures the

martingale of the off horse in the same manner; then passes out in rear of the near horse and stands to horse.

183. To harness without detail: **HARNESS.**

To Unharness.

184. 1. By detail, 2. **UNHARNESS.**

Unyoke.—At this command the wheel driver passes between his horses from the rear, unhooks the martingale of his near horse, and draws the martingale through the standing loop on the cincha; then does the same with respect to the off horse; unhooks the inside end of each breast strap, detaches the neck yoke, and hangs it on its spike.

Uncouple.—Each driver steps in front of his pair and uncouples. If the horses are facing the stable driveway, he turns them about to face the manger.

Unbridle.—He unbridles the near horse, puts the halter on, fastens the halter to the manger, and hangs the bridle on the upper peg next the heel post. He then unbridles the off horse in like manner.

Traces Off.—He disengages the near trace of the near horse and lays its middle over the saddle, toggle on the near side; disengages the off trace and lays it beside the near trace, toggle on the off side; removes the traces and hangs them on their peg. In like manner he removes and hangs up the traces of the off horse.

Unsaddle.—He unfastens the crupper of the near horse and places the attachments in the saddle; unfastens the collar strap and then unsaddles the near horse, placing the saddle on the lower peg. He removes

the blanket from the near horse and places it over the saddle, the folded edge away from the heel post. He then unsaddles the off horse in like manner.

Collar Off.—He removes the collar of the near horse, then that of the off horse, and hangs them up, the near collar next to the post, the zinced surfaces away from the heel post.

185. To unharness without detail: **UNHARNESS.**

To Harness and Unharness in the Field.

186. Executed as in garrison, but in such order as to suit the disposition of the harness. Thus, the order in harnessing is: **Collar, bridle, saddle, traces, couple, yoke.** In unharnessing: **Unyoke, uncouple, traces off, unsaddle, unbridle, collar off.**

While harnessing or unharnessing, the horses are ordinarily tied by their halters to their carriages, as follows: The lead pair to the right wheel of the gun or caisson or to the end of the pole; the swing or lead swing pair to the right wheel of the limber; the wheel pair to the left wheel of the limber; and the wheel swing pair, if present, to the left wheel of the gun or caisson.

In harnessing or unharnessing by detail, drivers stand to heel after completing each detail of the instruction.

Adjustment and Fitting of Harness.

187. Drivers will be thoroughly impressed with the importance of bestowing constant and unremitting attention on the adjustment and fitting of their harness.

They must learn early that a horse cannot properly perform his work unless he is made comfortable in well-fitted harness. If the harness pinches, galls, or otherwise causes him discomfort, his sole idea will be to escape from the annoyance or pain thereby occasioned him, and he will become fretful, nervous, and unsteady in his work. This will not only add to his own distress, through a useless expenditure of strength and nervous energy, but by rendering the draft of the whole team unsteady it will needlessly increase the work and fatigue of the other horses.

188. Drivers must be made to appreciate the fact that every sore, every injury, every abrasion of the skin, is due to a certain definite cause which, if removed, can produce no further effect. If ill-fitting harness has escaped the notice of a driver while his horses were at work, any injury caused thereby must not escape his notice at the next stables. Failure to discover and report such injury at once to the instructor or to the chief of section is a neglect calling for disciplinary correction.

189. Injuries due to the harness must be discovered in their very beginning and at once reported to the officer in charge of the horses. That officer then performs his duty unsatisfactorily if he lacks ingenuity and skill to modify or correct the fit of the harness so as to remove the cause of the injury.

190. It is only by constant attention on the part of all concerned—drivers, chiefs of section, chiefs of platoon, the officer in charge of the horses, and the cap-

tain—that the animals of a battery can be kept up to their work, without more or less prolonged periods of enforced idleness due to harness injuries.

191. The **bridle** and **saddle** are fitted as prescribed in paragraphs 230 and 234 D. and S. R. F. A.

The **collar** should fit about the horse's shoulders and neck easily and uniformly. It should freely admit the thickness of the hand between the lower part of the collar and the throat and, when pulled to one side, should admit the thickness of the fingers between the sides of the collar and the neck. A short collar chokes a horse by pressing on the windpipe; a narrow one pinches and rubs the neck. A broad collar works about and galls the shoulders. More injuries result from collars that are too large than from collars that are too small.

The final test of the fit of a collar is to observe it carefully when the horse is in draft and, at halts, to notice what effect it is having on his shoulders.

After a collar has been properly fitted to a horse it should be marked with his battery number. This is conveniently done by painting the number just above the left draft spring on the inside of the collar.

The **back strap**, when adjusted, should admit the breadth of the hand between it and the horse's back. If too short, the crupper will cut the tail and the saddle will be displaced.

The **collar strap** should not be tight; otherwise it will pull the saddle forward on the withers.

The **surcingle,** when used, should be buckled on the near side of the near horse and on the off side of the off horse, less tight than the girth and over it.

The **hip straps** should be so adjusted as to enable the **breeching body** to bear flat against the thighs and to rest from 12 to 15 inches below the dock. If this strap hangs too low, the action of the horse, when set into the breeching, will be interfered with; if it hangs too high, the side straps will rub the stifle.

The **side straps** are adjusted to cause the breeching body to bear quickly should the horse be required to check the carriage, but not so short as to impede the animal's movements while in draft. The exact adjustment can be obtained only by watching the horse in draft, both up and down grade.

The **martingale** is fastened by its cincha strap to the neck yoke. The length of this fastening should be such as to permit the D ring and D ring safe on the martingale to be well through the standing loop on the cincha, thus avoiding catching and interfering with the latter when the horse is set into the breeching. The martingale must be kept smooth and soft or it will chafe the inner sides of the legs and rub the belly.

The **breast straps** should support the pole in a horizontal position. If the pole is too low, the effort of supporting it is increased; if too high, the martingale and neck yoke may rub the breast.

The **loin straps** should be adjusted so that the traces, when in draft, will be straight and without downward

pull on the trace loops. Otherwise, galls on the back will result.

The **traces.**—The length of the lead and swing traces must depend in a great measure on the size of the horse and his stride. The rule for lead and swing pairs is to allow about 1 yard from head to point of buttocks when in draft. The length of the wheel trace is fixed, but allowance may be made for difference in the size of the horses by proper adjustment of the martingale and side straps. This will allow a minimum distance of about 14 inches between hind quarters and singletree for the average wheel horse when in draft. The traces should be adjusted by a strap under the belly or one over the saddle so that their direction shall be as nearly normal to the shoulders as possible to avoid any downward or upward pull on the collar. A downward pull on the collar will tend to gall or injure the neck, while an upward pull on it will tend to make it rise and choke the horse.

The rear trace chains of the lead and swing traces have a ring at one end and a hook at the other; the hook is passed through a "D" ring at the end of the trace and hooked back into any desired link. By this means the length of the lead and swing traces may be adjusted. Care must be exercised that the traces belonging to any one horse are of even length.

The **coupling rein** should be so adjusted as to permit the off horse properly to maintain his trace and yet to hold him to his place in the team.

Breast collar.—The breast collar should be adjusted as high up as possible without choking the horse.

Care and Cleaning of Harness and Leather Equipment.

192. Two agents are essential to the proper care of leather equipment—a cleaning agent and an oiling agent. The cleaning agent is castile soap; the oiling agents are neat's-foot oil and harness soap.

193. The castile soap is a commercial article containing 3 per cent. of sodium carbonate (lye), which is necessary to give it the required cleaning power. Its action, however, is merely to free the leather from the dirt, sweat, and other matter which normally accumulate on it in the surface pores of the leather.

194. The neat's-foot oil, which has been found by long experience to be the most satisfactory for this purpose, penetrates the pores and saturates the fibers, making them pliable and elastic. Dry leather is brittle; leather oiled excessively will soil the clothing and accumulate dirt. The condition to be desired is leather saturated with sufficient oil to be soft and pliable, without excess sufficient to cause it to exude.

195. In washing with any alkaline soap, it is impossible to prevent the removal of the surface oil. This leaves the surface hard and dry and liable to crack. It is difficult to replace this surface oil by a direct application without applying an excess. This has led to the development of various saddle and harness soaps with a view to obtaining a soft pleasing finish. Most of these contain more or less neutral oil, which replaces the surface oil removed in washing.

196. Daily, or as often as used, the equipment should be wiped off with a cloth slightly dampened in water, merely to remove mud, dust, or other foreign substances. It should never be cleaned by immersing it in water or holding it under a hydrant. This daily care will do much to maintain the appearance of the equipment, but is, however, insufficient of itself to properly preserve it. At intervals of from one to four weeks, depending upon circumstances, it is essential that the equipment be thoroughly cleaned in accordance with the following general instructions:

197. (*a*) Separate all parts, unbuckle straps, remove all buckles, loops, etc., where possible.

(*b*) Wipe off all surface dust and mud with a damp (not wet) sponge. After rinsing out the sponge, a lather is made by moistening the sponge in clear water, squeezing it out until nearly dry, and rubbing it vigorously upon castile soap. When a thick, creamy lather is obtained, thoroughly clean each piece of the equipment without neglecting any portion. Each strap should be drawn its full length through the lathered sponge so as to actually remove the salt, sweat, and dirt from each leather piece.

(*c*) After again rinsing the sponge, make a thick lather with the saddle soap as described above. Go over each separate piece, thoroughly working the lather well into every part of the equipment, remembering that its action is that of a dressing.

(*d*) After the leather has been allowed to become par-

tially dry, it should be rubed vigorously with a soft cloth to give it the neat, healthy appearance that is desired.

198. If the leather is soft and pliable nothing further is required. It will be found, however, that it will be necessary from time to time to apply a little oil. It is not practicable, owing to different conditions of climate and service, to prescribe definitely the frequency of oiling. It has been found that during the first few months of use a set of new equipment should be given at least two applications of oil per month. Thereafter, it is entirely a matter of judgment, as indicated by the appearance and pliability of the leather. Frequent light applications are of more value than infrequent heavy applications.

199. Before using, perfectly new equipment should in all cases be given a light application of neat's-foot oil; soap is unnecessary, because the equipment is clean.

200. **How to oil leather equipment.**—The quantity of oil, also, cannot be definitely prescribed, but it should rarely exceed a coverful of the individual soap box (1 ounce) for each set of horse equipment, or 2 ounces for each set of artillery harness. In applying the oil the following general instructions should govern.

(*a*) The oil should be applied to the flesh side of the equipment where practicable when the leather is clean and still damp after washing (about dry).

(*b*) The oil should be applied with an oiled rag or cotton waste by long, light, quick strokes—light strokes that the pressure applied may not squeeze out

the excess of oil, quick strokes that the leather may not absorb an undue amount of oil. The endeavor should be made to obtain a light, even distribution.

(*c*) After applying the oil, the leather equipment should be allowed to stand for 24 hours, if practicable, in a warm, dry place. It should then be rubbed with a dry cloth to remove any unabsorbed oil.

201. Reason for oiling.—The principle prompting the instructions given in (*a*) above is that the oil penetrates more uniformly when applied from the flesh side, while if the leather is dry it will absorb the oil like blotting paper, preventing proper distribution. The presence of moisture which tends to retard the penetration of the oil makes it desirable to oil the leather while still moist from washing. The more moist the leather when oiled the lighter the application that can be given; any equipment should be moistened, as in washing, before oiling.

202. An additional reason for consistent washing and oiling lies in the fact that practically all leather contains at least one-tenth of 1 per cent. of sulphuric acid acquired as a normal product of tannage. This acid, which if excessive will in time rot the leather, is neutralized by the alkali of the castile soap and to a less degree by the oil.

203. To summarize certain particular facts with a view to emphasizing them:—

(*a*) Keep leather clean.

(*b*) Keep leather pliable by frequent light applications of oil.

(*c*) Use only materials furnished by the Ordnance Department. Shoe polishes, etc., are almost invariably injurious.

(*d*) Dry all leather wet from whatever cause in the shade. Never in the sun or close to a steam radiator, furnace or boiler.

(*e*) Leather should habitually be stored in a cool, dry place without artificial heat.

204. In active campaign or on the march little protection can be given equipment. But at all times advantage should be taken of such opportunities as the situation affords, to first get the equipment out of the mud and then to protect it from rain and heat. This is accomplished by arranging the harness and saddle equipment on the pole and other parts of the carriage as prescribed in the Drill Regulations for Field Artillery, care being taken that no part of the equipment is dragging on the ground. All the equipment is then covered by the paulins for protection from the elements. Racks may be improvised with forked sticks and crossbar or advantage taken of a neighboring fence.

Cleaning Bits and Collars.

205. In cleaning such things as bits and the zinc-lined metal parts of the steel collar, no more force should be used than is necessary to remove such dirt, etc., as may have collected, which should first be soft-

ened by oil or water and then washed with a sponge, using Lavaline or Gibson's Soap Polish. In no case should emery or other abrasive be used. Whenever this zinc lining is worn through, this fact should be at once reported and the worn collar replaced by a good collar, otherwise there is danger of abrasions of the horse's shoulder and of collar galls.

Care and Cleaning of Saddle Blankets.

206. Saddle blankets should be opened, shaken, aired and refolded every week. If the same surfaces and folds are constantly exposed to wear, the blanket will soon be in an unserviceable condition.

Depending upon conditions of weather and service, saddle blankets should be washed with H. & H. Soap, aired and dried, and then refolded about two to three times a year.

Field and Surplus Kits.

207. The field kit consists of the arms, personal and horse equipments and clothing, additional to that worn on the person, required by and prescribed for the soldier in the field.

The articles comprising the kit vary with the duties of the men and are furnished by the Ordnance Department, the Quartermaster Corps, and Medical Department.

208. The field kit for individually mounted men consists of and is carried as shown below.

Ordnance Property.

(*a*) *Personal Equipment.*

Articles.	Where carried.
1 can, bacon	Near saddle pocket.
1 canteen	Near cantle ring.
1 canteen cover	On canteen.
1 cup (Mess kit)	On canteen, under cover.
1 fork (Mess kit)	Near saddle pocket.
1 knife (Mess kit)	Near saddle pocket.
1 spoon (Mess kit)	Near saddle pocket.
1 meat can (Mess kit)	Near saddle pocket.
1 pistol, belt, holster, magazine pockets, 2 extra magazines, 21 cartridges	On person, belt outside all clothing, pistol on right hip, first-aid packet on left of and toward front of belt, magazine pocket in front of first-aid packet.
1 pouch for first-aid packet	
1 spurs, pair	On person, buckles outside.
1 spur straps, pair	

(*b*) *Horse Equipment.*

1 bridle	On horse.
1 halter headstall	On horse.
1 halter tie rope	On halter, free end secured in rear pommel ring.
1 link	On bridle, free end snapped up.
1 saddle blanket	On horse.
1 saddle	On horse.
1 saddlebags, pair	On saddle, the saddlebag straps passed through the cincha rings and drawn tight before fastening.
1 surcingle	Over saddle, buckled on near side.
1 currycomb (Grooming kit)	Off saddle pocket.
1 horse brush (Grooming kit)	
1 feed bag	On saddle.
1 grain bag	In feed bag.

Quartermaster Property.

(*c*) *Equipment.*

Articles.	Where carried.
1 identification tag	Slung around neck by tape.
5 pins, tent, shelter 1 pole, tent, shelter	In blanket roll.
1 tent, shelter, half, mounted	Around and forming part of blanket roll.

(*d*) *Clothing Component.*

1 blanket	In blanket roll.
1 slicker	Rolled and strapped to pommel of saddle.
1 towel	Off saddle pocket, outside canvas lining.
1 comb 1 soap, cake 1 toothbrush	Wrapped in towel.
1 drawers, pair 2 stockings, pairs 1 undershirt	In blanket roll.

(*e*) *Rations.*

2 reserve rations, each consisting of—	
12 ounces bacon	In bacon can.
16 ounces hard bread	Divided between saddle pockets.
1.12 ounces coffee, R. & G.	In coffee bag of saddlebags, in near pocket.
2.4 ounces sugar	In sugar bag of saddlebags, in near pocket.
0.16 ounce salt	In salt bags of saddlebags, in near pocket.

(*f*) *Forage.*

1 feed, 4 pounds of grain	In grain bag.

(*g*) *Medical Property.*

1 first-aid packet	In pouch on belt.

209. When the sweater is carried and is not worn on the person it is placed in the blanket roll. When

the overcoat is carried and is not worn it is rolled and strapped on the pommel of the saddle.

210. To roll the overcoat or slicker.—Spread the overcoat on the ground, inside down, skirt buttoned throughout, sleeves parallel to the middle seam, collar turned over on the shoulders.

Turn the tails of the coat under about 9 inches, the folded edge perpendicular to the back seam. Fold over the sides to form a rectangle not more than 34 inches across, according to the size of the coat. Roll tightly from the collar with the hands and knees, and bring over the whole roll that part of the skirt which was turned under, thus binding the roll.

The slicker is rolled in a similar manner.

211. To make the blanket roll for mounted men.—Spread the shelter half (model 1904) on the ground, roll straps underneath, and fold over the triangular part of the rectangular part. Turn under the roll strap edge of the shelter half so that the width of the fold will be 8 inches. Fold the blanket once across the longer edges and lay the blanket on the shelter half, folded edge within 1 inch of the roll strap edge of the shelter half. Fold the sides of the blanket and of the shelter half inward, width of folds about 11 inches. The shelter tent pole and pins are now laid on the blanket at the edge farthest from the roll strap edge, pole on one side of the center line, pins on the other, so as to allow the roll when completed to bend at the center. Place the underclothing on the blanket. If

the sweater is to go in the roll, spread it smoothly over the blanket.

Roll tightly toward the roll strap edge, using hands and knees, and bring over the entire roll the part of the shelter half which was turned under, thus binding the roll. Buckle the two available roll straps about the roll, passing them around twice. The roll thus formed should be about 44 inches long.

212. To pack the feed bag for individually mounted men.—The grain is placed in the grain sack and equally divided between the two halves. The elongated grain sack is then placed inside the feed bag and the whole lashed tightly to the blanket roll by the web straps at each end of the feed bag, so that the open part of the feed bag is closed against the blanket roll. If empty, the feed bag, with grain sack enclosed and all web straps buried in the bag, is lashed to the blanket roll by the coat straps.

To pack the blanket roll with the attached feed bag, three coat straps are used, one to fasten the middle of the roll to the middle of the cantle of the saddle, and one at each end to fasten the end of the roll to the saddlebag strap ring. The blanket roll is placed on the cantle so that the feed bag will be uppermost. The coat straps are passed twice around the roll and buckled.

213. The equipment of each driver is the same as for individually mounted men with the exception of horse equipment and grain.

The driver's horse equipment consists of 1 horse brush, 1 currycomb, 2 feed bags, 2 grain bags, and 2 surcingles. Each driver carries a feed of grain for each horse. Halters, saddlebags, saddle blankets, etc., are included in the harness.

214. The driver's canteen is snapped in the near pommel ring of the off saddle. His saddlebags, blanket roll, feed bags, slicker, etc., are likewise packed on the off saddle. After attaching his slicker the driver turns the top of the roll over the pommel down into the saddle so as to avoid any interference with the rein roller on the off saddle.

215. **To pack the driver's blanket roll and feed bags.**—The grain is placed in the grain sacks and each sack placed in its feed bag. The two feed bags are tied securely together at their open ends, using the "nose and head" web straps, the two bags being tied as closely as possible to prevent the lower ends chafing against the traces. The two feed bags are then suspended across the seat of the saddle of the off horse and lashed in place by the 60-inch coat straps on each side, as follows:

Pass the coat strap under the rear quarter strap and take one turn around the nose bag, if necessary punching a "throat" into the bag near the lower end to prevent the coat strap slipping. The blanket roll being lashed to the center of the cantle, bring the free end of the roll forward so as to bind over the feed bag and take two turns around the end of the blanket roll with the

coat strap. Then pass the free end of this strap over the straps thus in place and buckle tightly. Do the same on the other side.

If more than one feed is to be carried, place the grain for the first feed in the closed end of the feed bag and lash the feed bag tightly with the rawhide thong. Put the remainder of the grain in the grain sack, and place the grain sack in the feed bag; secure the two feed bags to the off saddle as above.

The surcingles are carried one on each horse, buckled over the saddle.

With the exceptions noted, all articles of the driver's equipment are packed and carried in a manner similar to that described for individually mounted men.

216. In addition to the kits above prescribed, each corporal is provided with a housewife which he will carry in his haversack or off saddle pocket.

The members of the special details and of the headquarters company are provided with various equipment which they carry on their persons. The field glasses will be carried on the right side, the flag kit on the back, the strap in each case passing over the left shoulder.

An agent while on duty as such will wear on the right forearm a red brassard. Brassards are furnished by the Quartermaster Corps.

217. The field kit for cannoneers and all men not mounted, including Nos. 8 trained as spare drivers, consists of and is carried as shown below:

Ordnance Property.

(*a*) *Personal Equipment.*

Articles.		Where carried.
1 can, bacon 1 can, condiment		In haversack.
1 canteen		On right rear of pistol belt.
1 canteen cover		On canteen.
1 cup	Mess kit	On canteen cover.
1 fork	Mess kit	In haversack.
1 knife	Mess kit	In haversack.
1 spoon	Mess kit	In haversack.
1 meat can	Mess kit	In haversack.
1 pistol, belt, holster, magazine pocket, 2 extra magazines, 21 cartridges.		On person, belt outside all clothing on right hip, first-aid packet on left of and toward front of belt, magazine pocket in front of first-aid packet.
1 pouch for first-aid packet.		
1 haversack		On person.

Quartermaster Property.

(*c*) *Equipment.*

1 identification tag	Slung around neck by tape.
5 pins, tent, shelter 1 pole, tent, shelter	In blanket roll.
1 tent, shelter, half mounted	Around and forming part of the blanket roll.
1 blanket	In blanket roll.
1 slicker	Folded and placed between folds of one of paulins of carriages on which soldier rides.
1 towel	In haversack.
1 comb 1 soap, cake 1 toothbrush	Wrapped in towel.
1 drawers, pair 2 stockings, pair 1 undershirt	In blanket roll.

(*e*) *Rations.*

Articles.	Where carried.
2 reserve rations, each consisting of—	
12 ounces bacon	In bacon can.
16 ounces hard bread	In haversack.
1.12 ounces coffee, R. & G. 2.4 ounces sugar 0.16 ounce salt	In condiment can.

(*g*) *Medical Property.*

1 first-aid packet	In pouch on belt.

218. The remarks made with reference to the sweater and the overcoat in the case of mounted men (208) apply to cannoneers except that when the overcoat is carried, and not worn by the cannoneer, it is folded and placed between the folds of a paulin on a carriage of the section to which the cannoneer is assigned.

219. When the old model haversack and canteen are issued the personal equipment of men not mounted is increased by two canteen haversack straps. Such haversacks are slung from the right shoulder to the left side. The canteen is slung from the left shoulder to the right side, the strap passing over that of the haversack. Both ends of the haversack strap and the rear end of the canteen strap pass under the pistol belt.

When the old model canteen and cup are issued the cup is carried in the near saddle pocket by mounted men and in the haversack by men not mounted.

220. To make the blanket roll for men not mounted.—Lay the shelter half on the ground and fold over the triangular part.

Hold the blanket up by two corners, the shorter edges vertical; bring the two corners together, thus folding the blanket in the middle; take the folded corner between the thumb and forefinger of the right hand, thumb pointing to the left; slip the left hand down the folded edge two-thirds of its length and seize it with the thumb and second finger; raise the hands to the height of the shoulder, the blanket extending between them; bring the hands together, the double fold falling outward; pass the folded corner from the right hand into the left hand, between the thumb and forefinger; slip the second finger of the right hand between the folds, seize the double folded corner; turn the left (disengaged) corner in, and seize it with the thumb and forefinger of the right hand, the second finger of the right hand stretching and evening the folds. The blanket is now folded in six thicknesses.

Lay the folded blanket on the shelter half so that one of its shorter sides will be about 8 inches from the edge of the shelter half farthest from the triangular part. Place the underclothing on the blanket. If the sweater is to go in the roll, fold it and place it on the blanket with the folded edge of the sweater even with that of the folded edge of the blanket. Across the other short side of the blanket place the shelter tent pole and pins.

Fold over the sides and ends of the shelter half which lie outside of the blanket, causing the ropes and straps to be included within the folds.

Commencing at the end where the pole and pins are placed, roll the pack, using the hands and knees to insure the roll being made as tight as possible. Just before the roll is completed open out slightly with the hands the pocket formed by the 8-inch fold of the shelter half, and then draw the pocket over the roll, thus binding it. Care should be taken to draw the canvas over the ends of the roll so as to prevent rain and dust from entering the inner portion of the roll. The roll thus formed should be about 22 inches long.

The roll is secured to the limber chest of the carriage to which the soldier is assigned, by means of the straps provided for the purpose. The rolls carried on any one limber chest are evenly disposed on either side of the door lock.

It is frequently desirable, especially in a strong wind, for the men to work in pairs in making their rolls.

221. The surplus kit contains articles of clothing necessary in camps of several weeks' duration and to permit the replacement of clothing worn out in active operations. For these purposes the surplus kits are forwarded to troops when serving in instruction, maneuver, mobilization, and concentration camps, or when in active service temporary suspensions of operation, or other conditions, permit the troops to refit. In certain cases in time of peace the surplus kits may, when transportation is available, accompany the troops on the march.

222. The surplus kit of each man consists of—

1 breeches, pair
1 drawers, pair
1 shirt, olive drab
1 shoes, russet leather, pair
2 stockings, pair
1 shoe laces, extra pair
1 undershirt

223. The kit of each man will be packed as follows:

Stockings, rolled tightly, one pair in the toe of each shoe; shoes placed together, heels at opposite ends, soles outward, wrapped tightly in underwear, and bundle securely tied around the middle by the extra pair of shoe laces, each bundle tagged with the battery number of the owner.

The breeches and olive-drab shirt are not rolled.

224. Surplus kit bags at the rate of one to each eight men or major fraction thereof are issued to organizations by the Quartermaster Corps.

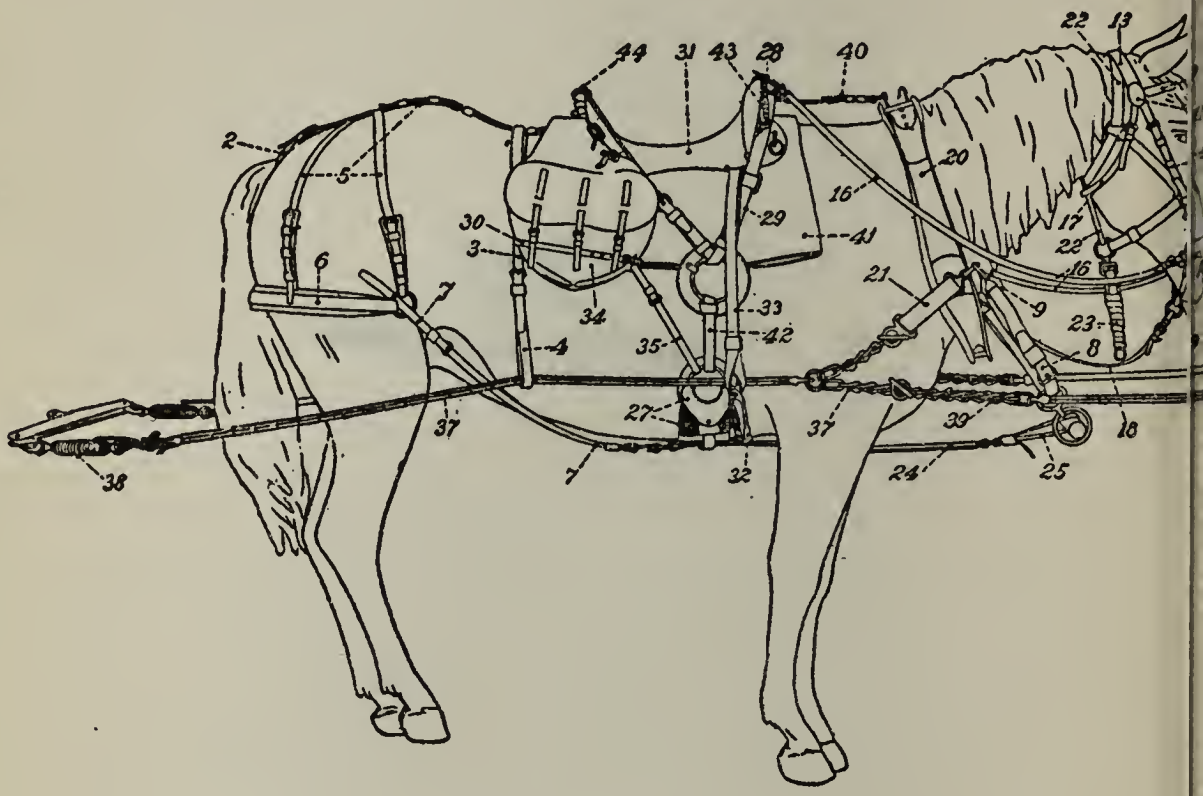
All bags will be uniformly marked in the center of the front cover flap. Those pertaining to a battery are marked with the battery stencil and with the designation of the squad to which the bag pertains; for example, the bag belonging to the drivers of the first section will be marked below the stencil, **FIRST SEC.**, and below that, **DRIVERS.**

Bags pertaining to the headquarters company and to the supply company are marked with the headquarters company and the supply company stencil and the serial number of the bag.

225. The shoes, underwear, etc., of each squad are packed in the surplus kit bag in two layers of four kits each; the breeches and olive-drab shirts are neatly folded and packed on the top and sides of the layers.

Nomenclature of Harness.

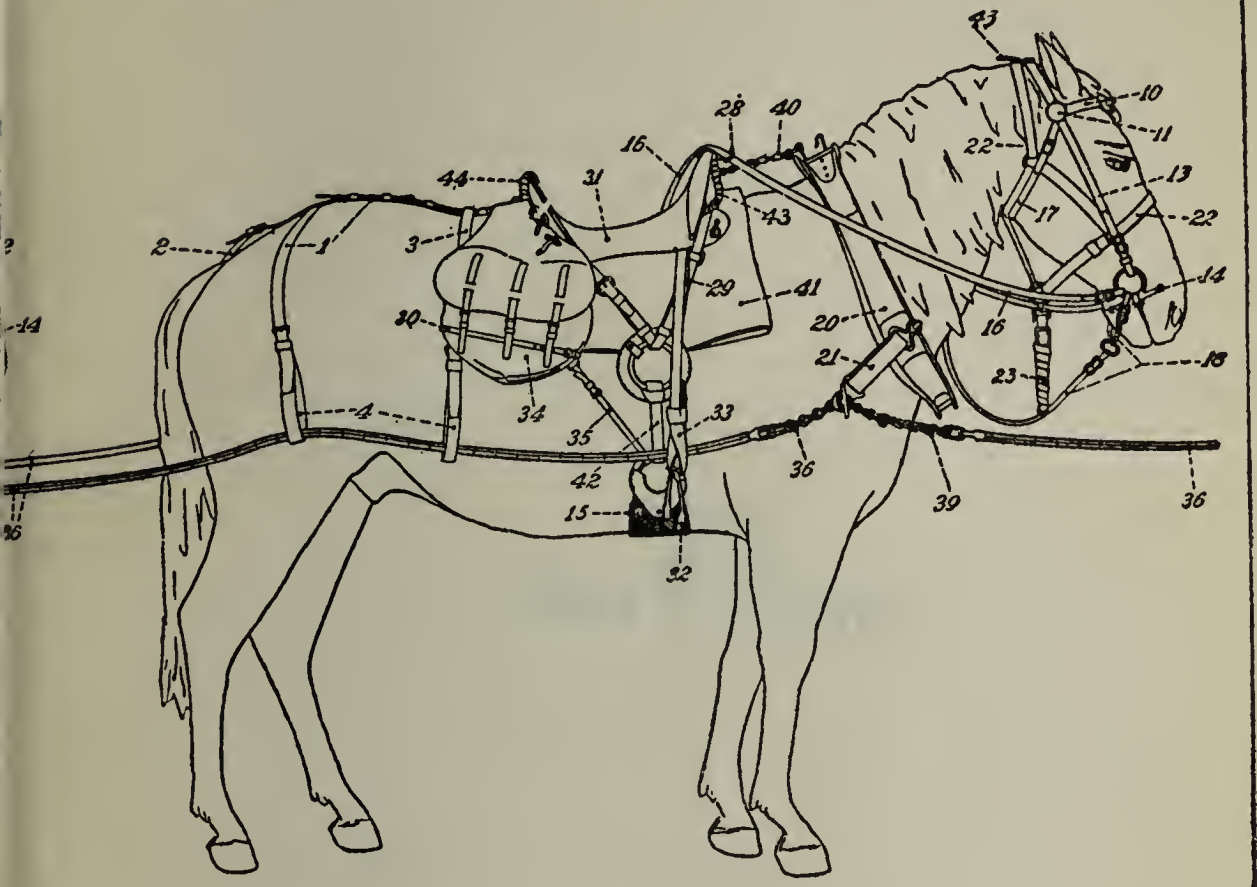
	Component Parts
1–4	Backstrap and crupper, complete, consisting of—
1	Body and hip straps
2	Dock
3	Loin strap
4	Trace loops
	Backstrap hooks
8, 9	Breast strap, complete, consisting of—
8	Breast strap
9	Breast-strap hooks
2–7	Breeching complete, consisting of—
5	Backstrap (1) and hipstraps (4)
6	Body
2	Dock
	Backstrap hooks
	Side strap hooks
3	Loin strap
7	Side strap
4	Trace loops
10–19	Bridle, comp., consisting of—
10	Brow band
11	Brow-band ornaments
12	Cheek piece
18	Coupling strap
19	Connecting strap
13	Crownpiece
14	Snaffle bit, model 1911
16	Reins (pairs)
17	Throatlatch
20	Collar, steel
21	Hame tug, part of collar
40	Collar strap
22, 23	Halter, comp., consisting of—
22	Headstall
23	Strap
24, 25	Martingale, complete, consisting of—
24	Margingale
25	Cincha strap
26–33	Saddle, comp., consisting of—
27	Cinchas, with reinforces and loops
15	Cinchas, without reinforces and loops
	Saddle—continued
28	Lead-rein roller and strap
29	Quarter straps, including rings, safes, and cincha straps
42	Cincha strap, part of saddle quarter strap
43	Coat strap, 33″ (pommel)
44	Coat strap, 45″ (cantle)
30	Coat strap, 60″
31	Saddletree, leather covered
32	Stirrups, brass (new style nickel steel)
33	Stirrup straps
34	Saddlebags
35	Saddlebag side straps
36	Traces, lead, model of 1908, consisting of—
	1 trace body
	1 trace cover
	3 links
	1 chain
	1 toggle
	2 sockets
	2 cones
	2 filler pieces
37	Traces, wheel, model of 1908, consisting of—
	1 trace body
	1 trace cover
	1 ring
	2 sockets
	2 links
	2 chains
	2 toggles
	2 cones
	2 filler pieces
38	Mogul spring, a part of wheel trace
	1 loop hook
	1 ring
	1 Mogul spring loop
	1 locking strap
	Whip
	Sweat leathers
	Blanket, issued with harness



Off Wheel Harness

Showing old-model bridle

Artillery Har



Off Lead Harness

Showing rear metal Bridle